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EDITORIAL NOTES.

Settlement of the Vertical Retort Litigation.

FROM an announcement that appears in another column, it will be seen that what promised to be a *cause célèbre* for the gas industry has been stopped by mutual agreement between the parties principally concerned. It will be remembered that the owners of the Dessau vertical-retort patents commenced an action against the Manchester Corporation for infringement of those patents by the installation and use of continuous vertical retort plant on the Glover-West system; and thus, for the first time, the English Courts, it was expected, would be called upon to adjudicate upon matters affecting the validity of vertical retort patents—intermittent and continuous; for it is plain that such a case could not have been fought without the fundamental claims of both systems being assailed. Nominally, the Manchester Corporation were the defendants; actually, West's Gas Improvement Company. Both sides were fully prepared to make a stout attack, and to offer a stout resistance—just as the owners of the Dessau patents have had to do more than once in the German Courts, with success in the completed cases.

However, so far as the action against the Glover-West system is concerned, it is at an end—an amicable agreement having been arrived at between the interested parties, which agreement will in no wise influence the conditions in regard to the construction in this country of the respective systems. In other words, there is no linking-up of business in this country between the parties; each will compete here on precisely the same conditions as heretofore without any limitation whatever. But though the gas-engineering profession has been robbed of what would have been an interesting technical lawsuit, there are advantages to the industry in the settlement; and therefore we can congratulate both the industry and the parties upon having come to terms for the cessation of hostilities. The result of litigation would have weakened either one side or the other; the "glorious uncertainties" of the law do not enable one to predict which would have been the weakened and which the strengthened party. It is—we do not say that it would have been so—quite conceivable that the result would have been that, with victory on one side, there might soon have been further litigious clouds over the vertical retort field; and the consequence might have been a considerable domination for some years to come of the new ways in the region of carbonization, instead of the maintenance of the comparatively open conditions that have hitherto existed. In the circumstance of the possibilities suggested having become realities, a powerful hindrance would have been set up to carbonization progress through the curtailment of present liberty to work for development, just as the action, proceedings in which have been determined, has, without question, been detrimental to the consideration and closing of new contracts for vertical retort-settings.

We compliment the parties on having arrived at a very sensible agreement, which expands the opportunities for business geographically and through the confidence that will be engendered as to patrons being free from the annoyance and anxieties that always attend litigation of this kind. We are glad things have ended as they have done, inasmuch as we are fully persuaded that it is best in the interests of not only the parties involved, but of the gas industry generally—the former of whom can now go forward with the technical and commercial development of their systems without any of the obstacles imposed by litigation, menaced or actual.

Considerations for the Parliamentary Authorities on the Chemical Clause Question.

THERE has been a break in the course of the stream of special favour shown to the chemical manufacturers, through the Alkali Manufacturers' Association, in the Parliamentary Committee rooms this session; and the break supplies a new position from which to attack the question. Briefly, the Unopposed Bills Committee of the House of Commons have declined to insert the chemical clause in the Swansea and the West Kent Gas Provisional Orders, upon the clear and succinctly stated facts and arguments advanced by Mr. E. Campbell Cooper and the witnesses he called in connection with the respective Orders—Mr. George Andrews, the Engineer and Manager of the Swansea Gas Company, and Mr. B. R. Green, the Consulting Engineer of the West Kent Company. The occasion furnishes an opportunity for asking the Parliamentary Authorities on Private Bills to give the matter fresh consideration.

The Chairman of the Unopposed Bills Committee (Mr. Whitley), during the proceedings on the Swansea Bill, stated that the Unopposed Bills Committee have not yet laid down any policy in the matter. We are glad to have this pronouncement, although it is very difficult for outsiders, and those intimately concerned in this matter, to reconcile it with the proceedings of the Committee up to the present this session. But Mr. Whitley went further, and said: "If I understand the views of the Committee, they "are that statutory companies created for a particular pur-"pose ought not to go beyond that purpose, except on the "evidence presented by the Committee, and that the Com-"mittee are prepared to hear each case on its merits." So far so good; but we have the fact before us that the clause has been inserted in several Bills this session without any opportunity for discussing the merits, and without the chemical manufacturers being called upon to show cause why the clause should go in.

In the first place, let us consider the bearing of the views of the Committee as stated by Mr. Whitley. What is the particular purpose for which a gas undertaking is created? The business of a gas undertaking may be divided into two distinct parts. The primary part (or the "particular busi-"ness" for which the undertaking is created) is the manufacture and sale of gas; and the secondary (or consequential) part, the dealing with the residual products arising from the primary business to the best advantage of the undertaking and of the gas consumers. Now with regard to the primary business, there is no competition in a given territory by gas with gas. This has been very properly decreed by Parliament in the cause of economy and convenience in each district. Gas is a utility that cannot be dealt with like commodities of a more substantial and transportable kind; and there is only one means of economically transmitting it from place to place. The secondary, or residuals, business comes into an altogether different category. In this branch of the business, there is no monopoly, in any one of the residuals, for any gas undertaking in any particular district. The varied demands of districts for the several products make any such restriction an economic impossibility. The crude or finished residuals of gas manufacture have therefore to seek the best possible markets. Consequently, the whole of the country from north to south and east to west is an open market for the sale of residuals, or rather was till the Parliamentary Authorities commenced this session placing restriction on *one competitor only*. Every gas undertaking is exposed, it cannot be helped because demand is so variably scattered, to local competition in the sale of its solid and liquid products from other gas undertakings, coke-oven owners, and chemical manufacturers. It would be quite possible, for instance, for the chemical manufacturers, if they felt so disposed, to go into the district of any gas undertaking, and spoil its local market for sulphate of ammonia, for tar, and for the derivatives of tar where (in

the last-named case) the gas undertaking does its own tar distilling. Therefore, it should be patent to the Parliamentary Authorities that the two parts of the business of a gas undertaking are quite of a dissimilar order, and subject to totally distinct conditions. Statutory gas concerns, let us repeat, have been created for the primary and particular purpose, under regulation, of manufacturing and supplying gas; and they have hitherto been left unfettered, in open competition, to do the best possible with the products resulting from the primary business, in the interests of the business. If the Parliamentary Authorities will get the conditions of these two divisions of the business well embedded in their minds, then it will be the easier for them to appreciate the new question in which the gas industry is this session so deeply concerned, through the action of the chemical manufacturers and the Parliamentary Authorities.

Mr. Cooper, in the course of his argument before the Unopposed Bills Committee, said he understood that the Committee would not take away the power possessed by a gas company who had been in the habit of using the power if they could satisfy the Committee that depriving them of the power would be to the prejudice of the locality. Conditions are daily altering; and it is in the public interests—in the interests of localities—more than ever to-day that the old residuals powers should be continued to gas undertakings undisturbed whether or not they have hitherto made use of them. The conditions, we say, are altering. In what way, or ways? In the first place, through trade strategy of the chemical manufacturers themselves. They are at liberty to conceive and use any proper strategy they choose; and this attack this year on the gas industry is but a part of their plans to restrict the residuals markets and operations of the gas industry. They make no secret of the fact. They are quite within their right in making the attempt; but that is no reason why the Parliamentary Authorities should aid and abet them in their trade schemes for weakening the position of those with whom they both do business and compete. As a matter of fact, the gas industry, in view of the power and liberty the chemical manufacturers already possess, wants the fullest commercial freedom in the residuals market. In the second place, the conditions are altering through the expansion of the gas industry itself, which expansion is daily showing more than ever that, in the public interests, in the best interests of localities, the full residual powers ought to be maintained to gas undertakings. The chemical manufacturers see this. They are futurists; and they desire—not in the public interests, but in their own—to curb to the utmost the residuals powers of the gas industry. They want to make the business, so far as is possible, their monopoly; and expense is no object to them in fighting for their own ends in the Parliamentary Committee rooms.

The Swansea and the West Kent Companies afford the illustrations of what we mean by the changing conditions. In the case of the Swansea Company, they have for years, had business relations with small gas undertakings in the locality—relieving them of their residual products to the advantage of the small undertakings, and consequently to that of their gas consumers. Those small concerns would have been placed in an awkward, profitless position (so far as liquid products go) had it not been for the power of the Swansea Company to purchase residuals, and work them up with their own. The West Kent Company (apart from any consideration of the question of amalgamation with the South Suburban Gas Company) have now arrived at a position when they could put down plant for dealing with all liquid residuals, and a plant of a size sufficient to enable them to be of assistance to a number of small undertakings within easy distance, on both sides of the Thames, of the works at Erith. If the West Kent Company are now in a position to make more profitable the residual products of those neighbouring undertakings, then, with the South Suburban Company in position at Erith, they would be in, at any rate, the same favourable situation for doing the same thing. Yet a Parliamentary Committee have said in effect to the South Suburban Company: "You shall not do it." Is this a reasonable position? Now we put it to the Parliamentary Authorities, Is it in the public interests, is it in the interests of the communities served with gas by undertakings who may attain to a position to effect such co-operation as is shown in these instances, that anything should be done by Parliament at the instance of competitors, to obstruct them in obtaining the largest possible profit from their residuals, and by such obstruction to put part of this profit into the pockets of the chemical manufacturers? The case of Swansea proves that there are economy and convenience in the retention of the power; but what Parliament has been doing this session is to say that this economy and convenience shall be denied to other gas undertakings as favourable conditions develop for the exercise of the full powers. We ask again, as these conditions develop, why should the markets be limited, and gas undertakings be compelled to play into the hands of the chemical manufacturers, who in competition are well able, without the assistance of Parliament, to look after themselves?

The chemical manufacturers have been, and are still, unfettered. Neither they nor the Parliamentary Authorities have ever yet given reasons why the gas industry should not be on equal terms with the chemical manufacturers in the competition. The Parliamentary Authorities are really treating the chemical manufacturers—probably much to the joy and amusement of the latter—as though they were weakly injured persons. The Parliamentary Authorities have not, so far as can be judged, stopped to inquire into the power of the chemical manufacturers, or into the lucrative nature of their unfettered business. The Parliamentary Authorities have been doing their best to make still more secure the position of these petitioners for a favoured nation clause, and to preserve to them, and to place under their control still more, the markets in which there is every reason there should be open competition. They have long held a *quasi*-monopoly in the residual products of gas undertakings of limited capacity. A statement made by Mr. Cooper shows that he was quite prepared to place before the Unopposed Bills Committee information as to what had been the practice of the chemical manufacturers, and what the results of that practice had been. But the Committee declined to listen to this. Mr. Green, too, stated in his evidence that he had heard that the whole of the country was mapped out by the chemical manufacturers, and that the policy was to assign particular areas to particular manufacturers, so far as the supply of ammoniacal liquor was concerned. He complained, too, of variations in prices in different parts of the country, and spoke of the difficulty of disposing of residuals at reasonable prices anywhere in the neighbourhood of London. He also alluded to profits going to the middleman or broker; and mentioned that he could offer better terms, through the West Kent Company, to small neighbouring undertakings, than could be realized by them from the chemical manufacturers. There is here food for thought for the Parliamentary Authorities. We remember in this connection how bitterly Sir George Livesey used to complain of the prices paid for tar, from which the distillers obtain such valuable products. The fact is the chemical manufacturers have been to a very considerable extent masters of the situation in relation to gas residual products in this country, and are seeking to curtail commercial freedom henceforward in the markets. The purpose of the present campaign, which has put the gas industry on the defensive, is so easy to see.

We therefore ask the Parliamentary Authorities to reconsider the question. Until last week, they have, it has seemed, been treating it as though consideration was finally closed. Upon reconsideration, we urge them to say that the markets for residual products arising from gas manufacture should not be restricted so that the prices can be ruled by anyone outside the gas industry without the industry having full opportunity and power of helping and protecting themselves. We ask them to say that it is not in the public interests that gas consumers should be deprived of the advantage accruing from being able to make the utmost profit that can be derived from the part of the business of a gas undertaking that is secondary to the primary purpose for which it was created, and that, in view of the open competition that exists in residual products, there ought to be no restriction of the markets for the raw products.

Spiral-Guided Gasholders.

WHAT there is to be known about different constructions of gasholders working under similar local conditions ought to be learnt at Oldham; for the Gas Department of this progressive industrial borough has no less than twelve holders, seven of which are column-guided, one has a flying lift, one is rope-guided, and the remainder are spiral-guided. The Engineer to the department (Mr. T. Duxbury) has become a firm adherent (until, if ever, there is some further superseding development) to the spiral-guided type, solely due to his

experience, that sums up the system as being one of the best of the modern contributors to the economies and the safety of works and supply. Considering the experience that there has been with the spiral-guided system under all sorts of conditions, dating back now to the Northwich holder of some 22 years since—a holder that does not incorporate the improvements of its successors, and yet Mr. S. Mellor, the Engineer, certifies has cost little in repair—it is not extraordinary that, with the faintest breath of suspicion that succeeded the Ilkeston disaster as to the reliability of the system as a system, there should have risen at once a volume of authenticated testimony that turned back the slight suspicion as being totally unfounded.

Mr. Duxbury, during the interesting visit of the Manchester Institution to Oldham last Saturday, added to that testimony by telling his experience with the spiral-guided holders, and valuable experience it was, though Mr. Duxbury seemed inclined to stamp it as only worth as much as time confers upon it. He says the first spiral holder at Oldham was erected in the summer of 1910; and he has not had a sufficiently long working experience with the system to give particulars of difficulties likely to be encountered, as, so far, he has not met with any difficulties. This is really most valuable testimony, as, under the conditions at Oldham, if no difficulties have been experienced there, then the system shows an unchallengeable elasticity, an adaptability, and an applicability to all conditions and to stability under the most severe circumstances. Four-lift spiral holders are the type that Mr. Duxbury has under his charge; but they are unlike each other in stature or in certain structural details—one is the largest holder of the kind ever erected, two are greater in height than in diameter, and one has round the outer lift only twenty spiral rails. These variations alone constitute, under like conditions of use, really valuable engineering experience. Then we see, too, that the holders have been assailed by strong gales in exposed positions; and under all the wind stresses to which they have been subjected, whatever the size, whether or not fully inflated, they have stood firmer than the vertically guided holders. Such large and varied experience we cannot value solely by its duration.

After recounting this experience, and summarizing in seven paragraphs the economic and safety advantages of the system, there seems to be a touch of dry humour in the form of Mr. Duxbury's concluding challenge: "The disadvan-"tages of the system I shall be pleased to learn from those "engineers who have had experience with spiral-guided "holders." A greater pleasure to Mr. Duxbury no doubt was to learn that the "disadvantages" are so small and so few that no one thought them worth mentioning—if there are any actually inherent to the system itself.

Parliamentary Conditions—The Three-Feet Depth.

Those who have studied the parliamentary proceedings in connection with Gas Bills this session will have seen, with an interest not unmixed with feelings of regret and of uneasiness, that new conditions are arising that demand very sharp and resolute resistance from their very inception; and they have also seen that decisions have been given by Committees of the same House that are diametrically opposed one to the other. There has, for example, been a standard price fixed that is only 1d. above the low current price of 2s. 2d. at York; and this 1d. margin may at any time be wiped-out by an increased charge for coal which is prominent among the possibilities, and by the new responsibilities in the way of labour charges, together with the extra liabilities that national legislation has imposed generally on industry and trade. There is no margin in the penny that indicates any proper interpretation of the judicial functions of Committees—Committees who are supposed to exercise a wise discrimination, and not create and inflict hardships that prevent the best working in the public interests, and act unjustly on capital investment. The scales should be held by them evenly between the two, but this is not always the case. Such decisions seriously disturb the confidence promoters of Bills and the investing public have entertained in the protection and even-handedness of those who have to deal in Parliament with the affairs of concerns under statutory control. The same remarks apply, with even more force, to the imposition of the chemical clause. Here we have seen public and statutory interests completely trampled under foot to the advantage of privately capitalized chemical concerns, without statutory restriction, which, through their innate conditions alone, constitute one of the strongest protected interests in the country. We cannot help speaking—as we have not hesitated to do before—plainly and strongly on these matters, as, with the majority of the administrators of the gas industry, we feel keenly the injustice of these proceedings. Is it impossible for the parliamentary authorities to realize that more than ever now, with strong competition in every branch of the gas industry, it cannot serve the public interests in the best possible manner by being screwed-down tightly on every side, at the request of local authorities or private competitors? To screw-down the industry in this way must tend to repress ardour and incentive in doing the best for the public interests; while the very competition against which the industry is actively fighting, and needs the utmost freedom in fighting, is the strongest protection the public interests can have.

Lifted into the arena of Committee-room polemics this session have been the questions of the amounts charged in revenue accounts for depreciation and maintenance and of distribution pressures. Fortunately the parliamentary authorities have not seen fit to intervene in these matters; but it is understood that they are going to be kept alive. They are, however, both points upon which there cannot be any positive fixed lines laid down that can be applicable to all circumstances, whether of time or locality. Yet there has been heard the cool assumption and suggestion that a definite low sum per 1000 cubic feet is sufficient for any company to charge for depreciation and maintenance; while the fact is the conditions of undertakings are so unlike, and the conditions from year to year so variable, that there can be no firm, or even approximately fixed, charge that would enable gas undertakings to work to the best interests of both the consumers and the concerns. In this respect, the averages of the past cannot be applied to the conditions of the present. This, however, is a matter that has been recently discussed in "Notes from Westminster;" and it can be left for the time being, though the gas industry must keep close touch upon this menace to a financial policy that is a means of permanently influencing the price of gas to the benefit of the consumers, and therefore of localities. As to the question of pressures, a fixed higher limit is unnecessary, for the very reason that gas undertakings are fully conscious that higher pressures than of old are necessary, and they give them during the hours of consumption. But it would be altogether purposeless to maintain during the whole twenty-four hours pressures that are only required during the local hours of consumption, which vary according to the character of districts. These are purely matters of administration; and again self-preservation, in the face of competition, is the best protection that the public interests can have.

The parliamentary authorities speak of their anxiety not to impose anything that will be repugnant to the public interests; and yet to give adequate protection to those interests. With all respect, we suggest to them that what is sometimes considered to be "adequate protection" really is inimical to the public interests; and certainly some of the impositions of this session are distinctly so. The chemical clause is one. There is another; and it is opposed to the public interests both from the cost that it will entail, and because it has no technical justification. If in this connection decisions by Committees were examined, Lord Ribblesdale's Committee would find themselves a solitary exception in having given a decision as to the depth of gas-pipes that cannot be vindicated either as a public necessity or on technical grounds. It will be remembered that, in the case of the Wandsworth Bill, the Committee imposed upon the Company the depth of a minimum 3 feet for future pipe-layings, although the Chairman of the Company (Mr. H. E. Jones) and other witnesses argued strenuously against it. The decision was given notwithstanding that two other Committees of the House simultaneously declined to put this additional and unnecessary expense on other Companies, and which additional expense is opposed to the interests of the gas consumers. What is to be thought of contrary decisions of this kind? It should be said, however, that subsequent to the decision of Lord Ribblesdale's Committee, his Lordship had the parties before him, and made this qualification quite clear to all concerned, "that the depth prescribed is not to bind the road authority "in its discretion to approve a less depth where satisfied "that such less depth would suffice."

This is all quite right, so far as it goes. Only the Surrey County Council appeared before the Committee, and claimed the 3 feet depth; the other road authorities saw no need

at all for doing so. Yet only a part of the district of the three amalgamated Companies is in the area of the Surrey County Council. Under the circumstances, it is hardly likely that the authorities who did not oppose will require much convincing that a less depth than 3 feet will suffice. There is the London County Council and the other authorities who have not thought fit to interfere in this matter; but so far as the district of the Surrey County Council is concerned, it can well be imagined that they, having opposed in the House, and got their point in this one instance, though refused in another, will hardly be satisfied that a less depth than that prescribed by Lord Ribblesdale's Committee is necessary. It was pointed out by us after the decision that the Committee did not appear to appreciate the technical aspects of the question, nor the load of practical difficulty they were imposing on the Company. There is the point as to foundation and not depth being the controlling factor in respect of the safety of pipes in connection with surface traffic. The matter, too, has to be looked at from the position of other users of the subsoil. A depth of 3 feet may bring a considerable expense upon these other users, who were not parties, and who were not heard in connection with the decision. Take the water-pipes for example. It is essential to carry water-pipes to a greater depth than gas-pipes, not for safety purposes in relation to surface traffic, but owing to the need for a greater amount of cover to protect the pipes against frost. We can imagine, for instance, that if the 3 feet depth were insisted upon for gas-pipes in the area of the Metropolitan Water Board, with their pipes of all dimensions, and their heavy number of connections, the Board, with only their 3 feet of cover, would find themselves in glorious difficulty and confusion at times when they came across gas-pipes laid at 3 feet owing to the mistaken decision of a Parliamentary Committee. The Gas Company, on the other hand, would be put into an awkward predicament in having to give a minimum depth of 3 feet with (say) at that depth, a huge water-main coming in their path, and the 3 feet prescription compelling them to tunnel right under it. The Lords Committees who have declined to prescribe a 3 feet depth for gas-pipes have acted wisely; the Committee who have prescribed the 3 feet have—with respect we say it, and believe they have done it without full knowledge of all it technically and financially involves—acted unwisely. But, to say the least, that such things as this are possible in the Committee rooms throws an unsatisfactory light upon the power for harm of Parliamentary Committees.

Matters such as those dealt with here, involving principles and precedent, are the concern of the gas industry generally just as much as of present-day promoters.

International Commission on Illumination.

A MATTER that appears to have been largely overlooked, and one upon which (it is not within our knowledge if it is otherwise) no serious movement has been made to ascertain whether the idea can be brought to a head, is a decision come to at the International Electrical Congress at Turin in September last, which placed upon record the view of the delegates that it was advisable an International Commission should be appointed in order to study all systems of lighting and technical problems in connection therewith—that is to say, that the study of the science of illumination should be pursued by an International Commission altogether independent of the illuminant itself. The matter is referred to in the annual report of the Council of the Illuminating Engineering Society, from which some extracts are published in another column.

On considering the matter, the first thing that naturally occurs is as to whether the components of such a Commission could study and report upon this polyhedral subject on strictly neutral grounds so far as the illuminant is concerned. Bias and the preservation of commercial interests, we are afraid, would escape to the surface, or, if reports were framed so as to remove all matters that might offend susceptibilities or affect interests, they would then indubitably be somewhat shallow and of questionable value. This is said without anything but suspicion to support it; it is said with before us the example of the Illuminating Engineering Society, which has (with only one small instance of a running away from an honourable understanding and rule) maintained, despite difficulties, a neutral platform, has done much good work, and has spread enlightenment on several subjects. And yet occasionally we cannot help feeling the real, though hidden, partition that separates the majority of the members. At the same time it must be admitted that the stock of knowledge has increased to larger dimensions through the work of the Society, and that it has been the means of inspiring men to fresh effort in the study of the problems of illumination.

When, however, we come to matters of record and report bearing the impress of a body of international standing, and carrying weight and influence beyond the pale of the technical realm into the commercial realm, then we foresee that rival interests and jealousies would be bound to come into action to repress any findings that may affect directly or indirectly any one side of those interests. The prediction may be wrong; we hope most sincerely it is. If such an International Commission on Illumination could be established and maintained, irrespective of illuminant and commercial interests, to study illumination questions in their hygienic aspects and to produce guiding standards, then we should welcome and support in these pages such an organization. It is, however, the place of the independent Illuminating Engineering Society to take the first steps in this matter. To it, in fact, was referred the initial movements in the endeavour to bring the proposal to a head. It has means of feeling the pulse of Institutions concerned in the subject. Its membership, as seen elsewhere in this issue, knows no bounds, so long as the members are interested in the provision of illumination in some way, or in the study of any of the scientific principles, problems, or effects of the illuminants. Therefore, its members ought surely to be able to approach and ascertain the views of the bodies whose representation would be needed to make such a commission perfect in its representation.

There is a sentence in the report of the Society which suggests that all that is required in order to set to work is that the gas industry should give its countenance to the scheme; the support of the electrical industry throughout the world being already assured. We are much afraid, important as are the problems of illumination, that the gas industry may at the moment look upon the matter from two adverse points of view, while not denying the importance of the illumination problems of the day. In the first place, the gas industry has found that International Commissions are rather cumbrous, slow-moving modes of procedure; and, just at the moment, the British gas industry at all events has its hands pretty full, what with the present position of parliamentary affairs affecting its interests, the work of its new Commercial Gas Association, the work at the Leeds University which deals with the fuel side of the gas industry's business, its educational schemes, and so forth. However, it is for the Illuminating Engineering Society to ascertain through its own members what, if anything, can be done in furthering the scheme for an International Commission; and we shall be glad to learn of the measure of success.

Gas Matters in Birmingham.

After making some reference to the large installation of Woodall-Duckham vertical retorts which is to be put in at the Windsor Street works, the Birmingham Gas Committee, in their report which is to be submitted to the City Council to-day, deal at some length with the subject of the recent coal strike and the manner in which it affected the department. It is pointed out that in June last the Committee entered into contracts for the delivery over the ensuing twelve months of a larger quantity of coal than they had ever before purchased in one year; and, in addition, they secured a substantial quantity of coal which was delivered on the works in the early autumn. Most of the coal used has to be carried a considerable distance to Birmingham; and the railway strike last August dislocated the services to such an extent that deliveries under contract fell considerably into arrear, with the result that (in spite of special efforts throughout the autumn and winter) the stocks held by the department at the end of February were much lower than would otherwise have been the case. An exceptionally heavy winter demand for gas still further depleted the stocks; and then followed the coal strike, during which supplies of raw material were practically cut off. An easily understandable unwillingness to risk the total exhaustion of the coal and oil stocks subsequently led the Committee to suggest curtailing the public lighting; and later on, for ten days (round about the Easter Holidays), it became necessary to restrict the output of gas from the works. As to the past

year's financial results, there is a surplus of £80,681, which, with the £3283 interest on the reserve fund, is to be paid over in aid of the rates; whereas last year the net balance was £75,621. This, too, is in spite of the fact the gas charges were reduced on two occasions during the past twelve months—the concessions in this respect being no less than 5d. per 1000 cubic feet. The heavy consumption during the winter months has already been mentioned; and the figures for the complete year show that the total sales were over 5 per cent. more than in the preceding twelve months.

Municipal Gas-Works Results.

At this season of the year, a considerable showing in the news columns is always made by the reports with regard to the working, for the financial period to March 31, of the gas undertakings which are in the hands of local authorities. A number of these reports for the year 1911-12 have come to hand; and they form very gratifying reading for those who have the welfare of the gas industry at heart. In practically every direction, substantial progress is, it will be seen, recorded. Taking some of the returns which have during the last few weeks been referred to in our pages, it may be noted that at Burton-on-Trent both the make and sale of gas per ton of coal carbonized are larger. Altogether the past year is stated to have been the most successful one in the history of the concern. There was a substantial increase in the sales of gas; and a reduction in the price of gas is proposed. The rates benefit to the extent of £7000. There is a gross profit at Coventry of £45,438, compared with £40,620 for the preceding year. A sum of £5000 is to be handed over in aid of the rates; while an amount estimated at £450 is to be utilized in the payment of a bonus to the employees of the department. In addition, £19,000 is to be set aside towards meeting the loss of capital consequent upon the abandonment of plant at the old gas-works. A reduction of 2d. per 1000 feet in the price of gas is proposed.

Some More Figures.

The net profit at Heywood is £1580, which is an increase of £432 on the previous year. With a smaller total make, there was a larger sale of gas; the quantity unaccounted for having been reduced to the small figure of 2·32 per cent., or 3·11 per cent. less than in 1910-11. The increased consumption was by means of prepayment meters and stoves and for motive power. In the case of Nelson, the profits of the Gas Department, so far as they relate to the relief of the rates, have, we learn, now reached the high-water mark. The net profit is £10,012, compared with £7666 for the previous year. There is an increase in the make of gas per ton, and in the profit per 1000 cubic feet. There is reported from New Mills a gross profit of £1060; and it has been decided to hand over £500 in relief of the rates. The make of gas was substantially larger than in the preceding year. More gas (to the extent of 2·18 per cent.) was sold at Nottingham; and the residuals markets were also better. The net profit of £49,710 is £2567 more than for the year preceding; and out of this the Committee recommend that £39,000 should be handed over in aid of the general district rate. There is an increase in the quantity of gas sold per ton of coal carbonized. For the period under review, the unaccounted-for gas has been reduced from 3·93 per cent. to 2·56 per cent.—which is a record for the undertaking. The net profit at Rochdale is the highest made; and an amount of £16,000 (£4000 more than last year) is to be contributed in aid of the rates, though the Gas Committee originally offered £15,000. The year was one of progress at Tiverton; the net profit of £702 being the largest made since the works were taken over by the Corporation. There were larger receipts from both gas and residuals; the gross profit being £3534, against £2861 for 1910-11.

The Rate-in-Aid Scandal.

It is high time that Parliament took more effective measures than the spasmodic ones that have been taken the last few years for putting an end to the ruthless plundering of the consumers of gas produced by local authority concerns by exacting enormous profits in aid of the rates. The length to which this is being done now amounts to a serious scandal. Time does not bring relief; on the contrary, rather than raise the rates (which the gas undertakings do not assist in increasing) the municipal authorities, despite the ardent protests of Gas Committees against the act, plunge deeper into the profits of the gas departments, and so rob the consumers of a cheaper gas service. The history of the Manchester Corporation Gas Department, for instance, ought to open the eyes of Mr. John Burns and the Local Government Board to the iniquity of what is being done. The fact that the huge sum of profits taken from the gas consumers is extracted largely from the pockets of the poor, and is devoted to relieving the rates of the richer section of the community, ought to very forcibly appeal to the President of the Local Government Board. The poorer part of the Manchester community belongs to the industrial workers of the country. Our pages bear testimony this week to the abuse in Manchester and Nottingham of this legalized robbing of the gas consumers through the absence of legislative control. The Manchester City Council, though there was resistance by the Gas Committee, have ordered the latter to hand over £50,000, in addition to saving the ratepayers £10,660 by supplying gas for street lighting at cost price. The Gas Committee had proposed (though this sum cuts against the grain) £39,340, *plus* the saving of the £10,660 by supplying gas for street lighting at cost. At Nottingham, again, £5000 more is to be taken from the Gas Committee than the sum they felt disposed to give—£34,000. Last year they handed over £32,000, and so were this year offering £2000 more. But they are to be compelled to make the sum £39,000, to avoid raising the rates. So the gas consumers are being squeezed. The fruits of their patronage—after paying capital, depreciation, and maintenance charges, rates and taxes, and all the current expenditure of the concern—are diverted from being applied to those reductions in price that patronage should enjoy. Why does not Parliament take immediate heed of this grave scandal in civic management?

More Company Promotion.

There are said to be large deposits of a combustible material known as ground sudd in the Soudan; and the local authorities of this country it is also reported have about 10 million tons of dustbin refuse thrown upon their hands annually. We have had a coal strike, and some benefactors of mankind who are interested in patent solidified tar—a substance which has been before us in connection with company promoting from time to time—find that, if they amalgamate solidified tar with "sudd" or dustbin refuse, they can bring into use the waste material from the Soudan, relieve numerous local authorities of their dustbin refuse, give householders and steam users a cheap solid fuel, and bestow wealth upon investors in their scheme that puts to shame the most avaricious dreams that any one of us has had. The immensity of the field for this fuel is seen from the fact that the upper reaches of the Nile would be provided with a fuel suitable for use there. We will not discuss certain very obvious technical and commercial defects of the scheme, which is backed by one or two men who write "C.E." after their names, but are not members of the Institution of Civil Engineers. A parent company is proposed—Suddine, Limited—for this scheme which is to be so beneficent to humanity. The prospectus informs us that the capital is only £7000, of which £6500 are 10 per cent. participating shares of £1 each, and 10,000 founders' shares of 1s. (£500). Ten per cent. on the preference shares is only a nominal dividend, as they are to participate in one-half of the divisible profits remaining after the 10 per cent., so it is estimated they will get 16 per cent., and then, by some magical means, the founders' shares are going to receive 80 per cent.—we take it calculating in shillings, and not in pounds. Though the founders' shares are rated at 1s. ones, the prospectus informs us that the issue price of them is £1, including premium; so that 10s. per share will be payable on application, and 10s. per share on allotment. We see that all the Directors, excepting one, are the same as those of the "Brighton Water Company" whose prospectus was noticed here a fortnight since. Sir J. Hawtrey Cox, Bart., Colonel the Hon. H. V. Duncombe, D.S.O., Captain John Maclean (one of the old directorial associates of the man Eaton), and John Greenfield, C.E., who in the "Brighton Water Company's" prospectus was described as a "water engineer" but in the Suddine prospectus comes out as a "fuel and chemical expert." The other Director is Mr. E. Nussey. Suddine, Limited, is proposing to establish a waste-fuel recovery industry; but what is badly wanted is a wasted money recovery industry with the fields created by the promoting Eaton and Preston gangs supplying the bases of operations. The investment in Suddine, Limited, by the way is recommended by the "Oil Fuel Securities Investment Company," with which the Chairman of Suddine, Limited (Sir J. H. Cox, Bart.), is associated, and F. Wilson, "C.E.," is Secretary. Wheels within wheels!

PERSONAL.

The Court of the University of Manchester have decided to confer the honorary degree of D.Sc. on Mr. DUGALD CLERK, M.Inst.C.E., F.R.S.

Colonel CHARLES LANYON OWEN, J.P., has been elected Chairman of the Portsmouth Water Company, in succession to the late Mr. William Grant.

Mr. FRANK HARDING JONES, M.Inst.C.E., has been elected a Director of the Monte Video Gas Company, Limited, in succession to the late Mr. Robert Morton. Mr. Jones, it may be remembered, is a Director of the South Metropolitan Gas Company.

Mr. F. BETLEY, who has been for many years Assistant-Manager at the Wigan Corporation Gas-Works, is recommended by the Gas Committee to the Town Council for appointment as Engineer and Manager of the undertaking, in succession to the late Mr. Joseph Timmins—the commencing salary to be £300 per annum, rising to £450.

In recognition of the sanitary work done by Mr. PERCY GRIFFITH, M.Inst.C.E., the Secretary of the Institution of Water Engineers, he was recently nominated as one of the limited number of members of the Royal Sanitary Institute who can be annually transferred to the higher grade of Fellows. The proposal came forward at the meeting of the Council of the Institute last Tuesday, and he was duly elected.

OBITUARY.

The death occurred last Wednesday of Mr. JOHN LLOYD, who had been Secretary of the Lampeter Gas Company for a number of years.

Members of the Wales and Monmouthshire District Institution of Gas Engineers will, we are sure, sympathize with their colleague Mr. F. Hill, the Manager of the Usk Gas-Works, in the bereavement he has just sustained by the loss of his son, Mr. HAROLD HILL, who was discovered dead in his office at the Llanwrtyd Wells Gas-Works, of which he was Manager, on the morning of Sunday, the 12th inst. At the inquest last Tuesday, it was stated that when Mr. Hill was found the room was full of gas, which had escaped from three unlighted jets of a cooking-stove. He had apparently slept in the office on the night of the 11th. A verdict of "Death by misadventure," was returned.

Dessau Company v. Manchester Corporation.

We are informed that a mutual arrangement has been arrived at between the owners of the Dessau vertical retort patents and West's Gas Improvement Company, Limited, of Manchester, under which recognition is made by the owners of the Glover-West system of the Dessau English patent; and, as a consequence, the action taken against the Manchester Corporation for alleged infringement of the Dessau patent has been withdrawn. This arrangement in no way affects the conditions under which the business in the construction of retort-settings either on the Dessau or the Glover-West system has hitherto been conducted in this country. In Germany, Austria, and Switzerland, the Dessau Company will become sole licensees of the Glover-West system of vertical retorts, and will construct same in conjunction with their own.

"Field's Analysis" for 1911.

We have received from the compiler, Mr. George Orford, the Assistant-Accountant to the Gaslight and Coke Company, a copy of "Field's Analysis," which has now reached its forty-third year of publication. Readers of the "JOURNAL" are aware that the contents have been considerably extended during the past few years, and now include analyses of the accounts of the principal gas undertakings in the United Kingdom. Two pages of the book are usefully occupied by comparisons of some of the principal items in the analyses with those of preceding years from 1907. Appended to the financial particulars are details of the coal carbonized, oil and spirit used, and gas made; the amount of capital employed per 1000 cubic feet of gas supplied on the days of maximum delivery; and the number of ordinary and prepayment consumers. It is interesting to note that the total number of gas consumers served by the three London Companies has risen from 1,145,660 to 1,178,517; those on the prepayment system being 768,753 on Dec. 31 last, compared with 736,542 at the close of 1910. The figures for the eleven Suburban Gas Companies whose accounts are dealt with are: Ordinary, 141,538; prepayment, 208,712—total, 350,250. For 1910 they were respectively 137,754, 196,446, and 334,200.

Mr. T. Oswald Pepper, Assoc.M.Inst.C.E., the newly-appointed local Manager and Engineer of the Andalusia Water Company, Limited, the registration of which was noticed in the "JOURNAL" last week, left Tilbury a few days ago for Algeciras.

NOTES FROM WESTMINSTER.

COMPARATIVELY speaking, things were very quiet in Westminster last week. There were no lengthy discussions as to gas matters before Select Committees; but a few points of interest have transpired. The Unopposed Bills Committee of the House of Commons have caused a turn in the tide in the matter of the infliction of the chemical clause by declining to recognize that the limiting stipulation should receive universal application. The Bognor Gas Company's (Electricity) Bill was in suspension the greater part of the week, in connection with questions arising as to the drafting of clauses to meet the agreement to which reference was made in our last budget of notes. But it was reported before the close of the week.

Blocking an Amalgamation Bill. We have previously referred to the fact that the members of the Labour Party who are opposed to co-partnership as it has a bad effect on socialistically directed labour unionism were proposing to make use of the machinery of Parliament to block the Gas Amalgamation Bills, which will extend the benefits of co-partnership to the workers, on the one hand, of the Companies to be united to the South Suburban Company, and, on the other, to those to be united to the Wandsworth and Putney Company. The South Suburban Bill was down for second reading last evening; and, simultaneously with its appearance for the purpose in the "Votes," a notice of motion was also lodged by Mr. Rowlands—who is a Liberal from the ranks of the working class, and represents the North-West (Dartford) Division of Kent—of his intention to move, according to the antiquated formula of the House, that the Bill be read that day six months. Of course, Mr. Rowlands' reasons for opposing may not be the same as those of the Labour Party. Now the game starts; but the House, it is pretty safe to say, will not allow such proceedings to be more than a temporary interruption to progress. That was the case with the Gaslight and Coke Company's Bill for the annexation of the West Ham Company and its territory.

Chemical Clause. The Unopposed Bills Committee have declined to insert the chemical clause in the Swansea and West Kent Gas Companies' Orders; but they have done so in the case of the Hatfield Company, who did not seem to be particularly concerned over the matter. The Lord Chairman has inserted the clause in the unopposed Bordon and Houghton-le-Spring Bills. It is a refreshing change to have to announce that two Orders have passed the Unopposed Bills Committee of the House of Commons without the clause. The proceedings, and the discussion between the Committee and Mr. E. Campbell Cooper (of Messrs. W. R. Cooper and Sons) give new points for thought over this matter as to the position of the Private Bill Authorities; and a few reflections will be found in our leader columns.

The Wandsworth Amalgamation. The Wandsworth, Wimbledon, and Epsom District Amalgamation Bill has grown in general interest since the new calorific and testing clauses have been inserted, and since the thermal property of the gas has supplanted illuminating power as the standard of quality on which penalty shall be determined in the case of any back-sliding not due to unavoidable causes. A fortnight ago, both in our editorial columns and in the "Notes," these and other interesting matters were fully dealt with. We will not traverse the same ground again; but, with the Bill before us as it stands amended at the present time, there are observed two or three matters to which reference may advantageously be made. In the first place, it ought to be clearly stated, as there appears to be some misunderstanding over the matter, that the insertion of the chemical clause in the measure was not due to any voluntary acceptance on the part of Mr. H. E. Jones, the Chairman of the Wandsworth Gas Company, and his colleagues. Its insertion was a master of compulsion. There is another point in respect of the 3 feet depth of mains that Lord Ribblesdale and his colleagues insisted upon for all future pipe-laying. It has been made plain that any of the local authorities in the amalgamated Company's area can agree to any less depth, if satisfied that the modification will suffice. The Surrey County Council were the only authority who asked for the 3 feet stipulation; but the Committee made it apply to all the authorities' areas, whether or not these authorities thought it necessary. The difficulties that the 3 feet condition involves are treated upon in our leader columns. Another matter. It will be remembered that the Rural District Council of Croydon desired that a provision should be inserted in the measure so as to provide that "the Company shall not close the existing works of the Wimbledon Company within the parish of Mitcham for the period of five years from the date of amalgamation; and during such period the Company shall continue to employ within the parish of Mitcham the same number of persons of the labouring class as were employed by the Wimbledon Company in the said parish during the year 1910, and shall continue to pay the same aggregate sum in wages as was paid by the Wimbledon Company during the same year." The Private Bill authorities are of opinion that it is not in the public interest that the Company should have all these limiting conditions placed upon them, in view of economy of working being the main argument in favour of the amalgamation. They have therefore deleted all that follows the word "amalgamation;" so that there will not be any obligation on the part of the Company to employ

at Wimbledon the same number of men, nor to pay the same amount in wages. But this is certain, that the old employees will not be at any time turned away while the Company, in their works or district have suitable employment for them. If the parliamentary authorities consulted the public interests in other matters as in this, the public interests, and not the chemical manufacturers' interests, would have had precedence in the matter of the chemical clause. The other minor changes in the Bill may be left for notice until the measure has run its course, and the Act is before us.

Forcing an Extension of Limits. It is not often that local authorities try to compel gas companies to increase their territory in the public interests; but this has occurred in the case of the Houghton-le-Spring Gas Bill. The matter was before the Standing Orders Committee on Wednesday last, on a petition for additional provision. As drafted, the Bill sought to extend the limits of supply so as to include the areas of East and Middle Herrington, West Herrington, Penshaw, South Biddick, Bournmoor, Little Lumley, and Morton Grange. A petition to the House of Lords was lodged by the Chester-le-Street Rural District Council asking that the Bill should not proceed so far as the extensions were concerned unless the parishes of Great Lumley, Lambton, and Cocken were also included. The Gas Company thereupon asked that the Standing Orders should be suspended so as to include these three areas. The Committee complied, so that the Rural District Council, the three parishes, and the Gas Company are all satisfied.

A Big Water Fight. Part 5 of the Sheffield Corporation Bill contains clauses referring to the construction of new water-works, the discharge of water into streams, the laying and removal of pipes, &c. This part has provoked a tremendous amount of hostility. The matter is being considered by Sir Henry Kimber's Committee; and a little army of the wearers of silk and stuff gowns daily appears before them looking after the interests of promoters and opposition. The Duke of Norfolk, the Sheffield and South Yorkshire Navigation Company, the West Riding of Yorkshire Rivers Board, owners, lessees, and occupiers of manufactories, mills, and other works are represented. The Rotherham and Doncaster Corporations and the Wortley District Council also have Counsel looking after their interests. The proposals refer to the Rivers Rivelin and Loxley; and the questions involved appear to be mainly of water compensation, or, as an alternative, money compensation. The matter is one of purely local concern; and it will be sufficient to notice the result when arrived at. Up to last week, the witnesses called included Alderman R. Styring, Mr. William Terrey (General Manager of the Corporation Water Department), and Mr. E. M. Eaton.

Glasgow Water. The Committee of which Mr. J. J. Mooney is Chairman heard a great deal about Glasgow water last week. In the first place, the districts round about Glasgow introduced to the Committee's notice a Bill in which they proposed that the charges outside and inside the city should be approximately equalized. The Committee heard a large part of the case of the promoters, then shortened it, and finally intimated that they did not want to hear a reply from Glasgow to enable them to decide that the preamble was not proved. It was an abortive journey that the outside districts of Glasgow had made to London. A different fate met the Corporation Water Bill, which went through with but little trouble. All the Corporation desired was power to lay two additional 36-inch mains to improve the pressure of water in certain districts. The only matter seriously discussed were clauses for the protection of the Caledonian Railway Company.

Manchester Public Lighting.—Mr. Jacques Abady has been engaged by the Gas Committee, and Mr. Haydn Harrison by the Electricity Committee, of the Manchester Corporation to prepare a joint report on the methods of lighting best adapted to the local conditions.

French Water-Works Syphon.—A cast-iron pipe syphon forms part of the water-works system of Apt, in the Department of Vaucluse; and the following notes regarding it, translated from an article by M. Minguier in the "Annales des Ponts et Chaussées," were recently given in "Engineering Record." The syphon is 3133 feet long, and taps a well sunk in the water-bearing sand and gravel near the River Coulon, eight miles distant from the city. The water-bearing stratum at the point of collection has a thickness of 14 ft. 9 in., and is covered with 3 feet of earth. From the bottom of the well, at an elevation of 997 feet, there extends vertically a 12-inch cast-iron riser, 11 ft. 6 in. long, which makes a 90° bend at its top, and connects with a pipe-line laid at a slope of 0·004, which is 0·001 less steep than the slope of the ground-water table. The lower end of the syphon line is at an elevation of 995 feet, and discharges into a gauging manhole. The discharge is limited by means of a valve to about 660 gallons per minute; for if a greater quantity is taken, the level of the water in the well is lowered too rapidly. Since the centre of the pipe at the top of the riser in the well is at an elevation of 1088 feet, the line constitutes a true syphon; but M. Minguier points out that it is unusual in one respect. Since it is below the ground-water level, there is nothing to fear if the syphonic action should stop; for the syphon would soon be primed automatically by the rise of the water in the well. It has been working for 22 months. As it is entirely covered with water, the interior pressure at its summit is never below that of the atmosphere.

ELECTRICITY SUPPLY MEMORANDA.

Resuscitated—Raising the Price—Talk and Merits—Loose Electrical Statements—A Mountain of Truth and a Grain of Error—Independent Tests—Depreciation and Loan Repayments—Limitations of the Electric-Cooker.

THE resuscitated Electric Lighting Bill (promoted by the Incorporated Municipal Electrical Association) has been presented in the House of Commons, and has been printed and published. Why it should be called an "Electric Lighting Bill" is not clear, as it deals with many other matters than lighting. The objects of the Bill have been treated upon on previous occasions; and it was then seen the promoters of the measure ask for wide and in some respects unprecedented powers to be conferred upon local authorities. Companies, too, have been dragged in by the heels, though companies have not the honour of being mentioned in the title of the Bill. As was apparent by the reference in the "Memoranda" in the "JOURNAL" for March 19, this dragging-in of companies to give them, as well as local authorities, power to supply fittings was a sort of after-thought, and a sop to them to engender good feelings towards the measure, and to persuade them to loosen their purse-strings, and assist in the provision of money to enable local authorities to get the power to provide electrical fittings. Perhaps, too, the promoters think that, if the application is made general to local authority and company undertakings alike, the Bill will present a better appearance in the sight of those who regard municipal trading as a principle that ought to be shunned, and, where existing, never unnecessarily extended. We see, too, that the promoters are willing to have the powers restricted to the areas within which the respective local authorities are authorized to supply electricity. This is extremely considerate. May we make a suggestion? Perhaps the experience of the National Construction Company at Canterbury and elsewhere would be of service to the promoters in furnishing evidence in support of the measure. That Company are in Parliament this year, and would be glad to see a little solid cash from certain places in which they have sunk money, but which are not profit-yielding.

A sign of the times. The Charing Cross Company are among the suppliers of electricity who find some of the contracts they have had running are not remunerative. The Chairman was talking at the last meeting of the shareholders about putting an end to such contracts as early as possible; but, of course, the outside public do not learn anything about any changes made by a company unless the changes happen to refer to a public authority. The Company supply the head office of the Metropolitan Asylums Board with current for lighting and power. It transpires (owing to the Board being a public authority) that the Company have given notice of their intention to determine the contract with them at the end of June, though prepared to enter into a fresh agreement at 3½d. per unit for lighting, and 1½d. for power and heating, as compared with 3d. and 1d. This has been accepted. However, the contract has been running since 1904; so that the reasons for the rise after all these years, during which business has expanded largely, and works' costs have diminished, are not alone centred in the increased price of coal and the Company's obligations under the Insurance Act. Gas prices have been decreasing; and dividends and revenue continue to expand or are maintained. Supply of energy for power purposes at low figures has caused sad havoc to the average revenue per unit of some undertakings.

Really it is difficult to understand some of our illogical friends of the electrical industry. We cannot pick up a paper connected with it without finding someone bleating about co-operation between all its sections in the stirring up of new domestic business, and at the same time asserting that electricity is incomparable for all domestic purposes. In another part of the same paper, it is practically certain that one will find someone cataloguing the drawbacks from which electricity suffers in the matters of wiring, and of initial and wear and tear costs of appliances. In the same paper, possibly, it may also be found that a writer in one part favours steady movement in introducing cooking appliances by in the first place taking up the lighter kinds, leaving heavier cooking appliances to be cultivated later. Farther on in the paper another writer may be discovered urging administrators of electricity undertakings to go straight away for the heavier cooking appliances, and supply at a low cost per unit. One correspondent of an electrical contemporary the other day was hot on something more effective being done to fight the "gas bogey;" and, after all the serving up of stale suggestions that one has heard at the Institution of Electrical Engineers, this correspondent wants more conference, and suggests that the parties to it be the Electrical Contractors' Association, the Municipal Electrical Association, and the British Electrical Manufacturers' Association. Why not let those superlative merits of electricity of which so much is heard work their own way without such a fearful amount of talk? We have never known a commodity whose intrinsic value is placed so high as that of electricity by its salesmen that has required so much work, talk, and stumping the country to try to get people to believe in it. As a rule, merit advertises itself.

"Meteor" of the "Electrical Times" has attempted, by the aid of some extraordinarily loose sentences, to force himself to the front in connection with the Brighton cookery tests. He says that "we"—the "we" being the singular "Meteor"—"have immensely enjoyed the 'JOURNAL OF GAS LIGHTING'S' method of dealing with Mr. Joseph Cash's admission of a considerable blunder." This is the true electrical style of exaggeration. The

"considerable blunder" was one figure out of many, and referred to one test out of the results of six tests that were quoted in the article; and the error, or the "considerable blunder" occurred in the baking of six sausage rolls and nine small fruit cakes. Now what has "Meteor" to say to the results in all the other tests? In another place, it is suggested that Mr. Cash would be consulting his best interests if he called in the "circulars which have been distributed broadcast all over the country." Mr. Cash has not distributed any circulars broadcast over the country. "Elegant" truly such exaggeration! But "Meteor" by no means agrees with the comparative statement even now. Without a categorical explanation as to the reason why, people have the right to regard the mere expression of "Meteor's" disagreement as another example of characteristic electrical evasion of a knotty point. Measured by his own bushel, too, a "considerable blunder" on the part of this same flighty "Meteor" is that he says the "nominal price of gas" at Brighton, "is 2s. 9d." The price is 2s. 10d., and it is actual; and if he takes the trouble to read and study the Brighton tests himself (which were published in our columns on April 2, not forgetting the deduction of 1 unit and 1d. in test No. 2), he will see that the charge for gas is 2s. 10d., and on that charge the consumption figures are calculated.

The electrical industry—and "Meteor" as one of its members—seem to think the Brighton tests are the only comparative ones that have been made—from baking down through the whole of the operations of the kitchen to the boiling of water for "washing-up" purposes. He and his like are very much mistaken. He fancies he traces a close resemblance between statements circulated by the Gaslight and Coke Company and the results of the Brighton tests—the insinuation being that the former have merely copied from the latter. That is incorrect. The Gaslight and Coke Company have also had comparative tests made by expert cooks; and on the results, they have stated that "Careful tests have clearly proved that (with electricity at only 1d. per unit and gas at 2s. 6d. per 1000 cubic feet), the relative costs of cooking by electricity and by gas are as more than 3 to 1 in favour of gas." "Meteor" does not deny this, except by (in such a connection) the disingenuous method of implication. The Brighton test in which both ovens were put to the greatest use was No. 5. In that test, a joint of meat, potatoes, cheesecakes, sardine eclairs, and cheese savouries, were cooked, as well as a quart of water boiled. Remember in these tests the charge for gas was 2s. 10d.—not 2s. 6d.—per 1000 cubic feet, and electricity 1d. per unit. The expenditure for electricity was 2·6d.; that for gas, 0·85d. In view of the difference in gas charge, does not this give full confirmation to the statement of the Gaslight and Coke Company? Moreover in the electric-oven the food was not so well cooked as in the gas-oven. A mountain of truth is overlooked in the joy of having a grain of error about which to talk, and talk loosely. The electrical papers also ignore the fact that Mr. Grogan had a chance while in Brighton recently of seeing the tests in question repeated; but Mr. Grogan did not take advantage of it.

The electrical papers, by the way, have overlooked the tests recently published in "Food and Cookery" [*ante* p. 152]. If we remember rightly, "Meteor" on one occasion called attention to some figured statements that had appeared in "Food and Cookery," and glorified them by inferring that they bore the editorial imprint. As a matter of fact, the Editor had taken care not to stand surety for the accuracy of the tests, as he had inserted the safeguarding word "Communicated" under the heading to the paragraph giving an account of them. There are the subsequent tests in that periodical which tell an altogether different tale. These tests, at any rate, show that independent investigation does not support electrical claim. The results of independent tests are worse, in fact, for electricity than those that have been made by various gas undertakings. The Food and Cookery Association are prepared to carry out independent tests, and to cook food equally in and on gas and electricity ovens to the point that is considered the one at which the food is properly done. Will "Meteor" kindly tell us why the electric-oven manufacturers have not had recourse to the Association for procuring comparable results—that being a quarter in which expert cookery is carried out, free from the shadow of suspicion of favour or the contrary cast by the knowledge that tests have been conducted by those having a commercial interest in the result? There is a particular reason for an answer being given to this question; and "Meteor" will much oblige by making inquiry for us in the proper quarters.

The controversy continues in the "Bucks Herald" over the proposal to establish an electric light station at Aylesbury—the principal disputants being Mr. T. E. Pye, the Engineer and Manager of the Chichester Gas Company, and Mr. R. V. Weare, the Electrical Engineer of the same city—a deputation from Aylesbury having made the old-world city the place for investigating electricity supply. Then the game started; and Mr. Weare raised aloft the total figures for the electrical industry's operations for the admiration of the good people of Aylesbury. Mr. Pye stepped in, and pointed out how deficient these figures were in sinking fund, or loan repayments, and depreciation, and also that total figures of the kind cannot be any guide to Aylesbury, but only the returns from towns of similar position. The figures were quoted from the "Electrical Times;" but that paper does not seem to fully appreciate its own returns. Mr. Pye took the figures for 1909-10 for the whole of the electric light undertakings (311) whose returns are analyzed. Quoting from our contemporary's own table, we have these items, "Depreciation and reserve (companies) and sinking fund and loan repayments (local authorities) £1,493,332;" and a little lower down, "Amount provided for depreciation and sinking fund, per £100 of capital, £2·47." The comment of the "Electrical Times" upon this is that Mr. Pye "makes much of the fact that the percentage provided for depreciation is but 2½ per cent. of the capital—this being *in addition* to repayment of capital and the interest on loans." Of course, Mr. Pye was right, and the "Electrical Times" was wrong on its very own returns. The capital of the undertakings dealt with is £60,552,721; so that the 2½ per cent. is not in addition to repayment of capital, but, as Mr. Pye had previously held, inclusive of the loan repayments. That is another "considerable blunder," and a very silly one, too.

The "Engineering Correspondent" of the "Daily Telegraph" has referred to the subject of cooking and heating, and has held the balance fairly between gas and electricity. There are a few warning remarks in his article for the electricians, who are divided in opinion on this subject. He points out to them that reliability and convenience are important factors in this matter. Everybody in the electrical and gas world knows that the supply of electricity is not reliable; everybody knows that electrical apparatus is not reliable, that the wear and tear upon it is greater than is the case with the gas-stove, and that the expense of renewals is larger. He also, in effect, points out to electricians that simplicity in charge and in apparatus, together with reliability, has given gas the place that it possesses in the world's affairs. He twits the electricians with their complicated charges. He recognizes that paterfamilias wants to reduce, and not to increase, his liabilities; and increase them he cannot help doing if he displaces an agent of superior heating value for one of less value. One of his correspondents looks at the matter from the technical side, and deprecates the putting-down of generating and distributing plant for the supply of electricity at 1d. per unit for cooking spasmodically for six months in the year. There is not much present cause for alarm at central stations over this point; as the extensive public disinclination to take the electric-cooker people at their own valuation has kept many central station engineers from making fools of themselves. They are having their little dabble here and there; and people who have assisted them in it by becoming patrons begin to regret having invested in a method of carrying out culinary operations that have so many limitations, and such a short range of effective heating capacity.

Designing Interior Illumination.

In the course of some articles in "Progressive Age" on "The Significance of Originality in Modern Gas Lighting," Mr. F. L. Godinez offers the following remarks: "In order to design interior illumination in accordance with the modern conditions of commercial practice, it is necessary to ensure satisfaction; and this may be accomplished only by eliminating all variable factors which might affect the efficiency of the system. The colour of a wall may change, affecting thereby the efficiency of a system dependent upon light reflected from above. In a similar manner, the accumulation of dirt on a reflector, allowing considerable light to pass upward through it towards the ceiling, will greatly impair the efficiency of a system composed of such units; whereas equal accumulation of dirt upon the surface of a reflector of dense opal glassware interiorly depolished, not dependent upon ceiling or wall reflection, would cause no decrease of intensity on the useful plane. Any reflector is affected by the variation in candle power of an illuminant; and very often illuminants, when replaced, are not selected with respect to proper size or rating. This is an additional reason for assuming an intensity of illumination higher than the average given for any particular application, since by so doing the effect of depreciation on intensity is not so marked. In designing illumination, do not begin by figuring how many lamps or reflectors can be installed for a total number of watts or cubic feet of gas. Study the interior, and compare it in your mind with others devoted to a similar purpose. Visit the display-rooms of representative fixture houses, or consult their catalogues, with a view to finding something different and pleasing, yet within the cost limit. The suggestions conveyed by the preceding illustrations will prove of great assistance."

Gas and Oil Engines.—We have received from Messrs. Scott, Greenwood, and Son, of the Broadway, Ludgate Hill, E.C., a little book bearing the above title. It is a translation by Mr. Charles Salter of a German work by Herr Alfred Kirschke, Lecturer at the State and Municipal School of Handicrafts at Halle. The translator has adapted the text to English practice, and produced a useful handbook containing a concise account of the most important types of gas and oil engines. After some introductory remarks, the author explains the constitution of coal gas, then refers to the precursors of the modern gas-engine, and describes the four and two cycle engines and the new Otto engine. The succeeding chapters are devoted to the construction and erection of gas-engines, and a description of the Diesel engine is given. Remarks are then offered on gas-producer plants, blast-furnace gas and other industrial waste gases, high-power gas-engines, and working costs; and the relative merits of the gas-engine, the steam-engine, and the gas-turbine are discussed. Following the text, which occupies 134 pages, with 55 illustrations, are tables of logarithms, &c., and of metric equivalents.

CONTROL OF ILLUMINATING GAS SUPPLY IN THE UNITED STATES.*

THE Bureau of Standards at Washington has undertaken a study of the methods employed in the United States in the official inspection and testing of illuminating gas, and has published in the "circular" before us the results of this study so far as the legal requirements relating to the testing and inspection service are concerned. The investigation of these requirements was deemed a necessary preliminary to the study of the methods employed; and another circular is to be issued later on the chemical testing of gas and the measurement of candle power and heating value. It is pointed out that the attitude of the Bureau is entirely advisory, and that the desirability of laws or ordinances controlling gas companies need not be discussed in the circular. But, the Director of the Bureau observes in his introductory remarks, "it is proper to emphasize the fact that the value of such legislation is not wholly to the public. There is no doubt that the public can be, and is, protected by the existence and observance of such laws, and that the advantage to the public is in proportion to such protection. However, in proportion to the benefit thus gained by the consumer should also be the gain to the company, since one of the essentials of success for a public-service corporation is public confidence; and by no other means can it so surely gain this as by a feeling of security on the part of the public itself. On this basis, any equitable law and its enforcement should be welcome to the company as an aid in the maintenance of a proper relation between it and the public."

We do not like this piece of special pleading by a Government Office in favour of legislation for the control of gas companies. Public confidence can be more surely gained by a public-service undertaking by an intelligent observance and fulfilment by it of the needs—varying from time to time—of the public which it serves than by the existence and enforcement of controlling laws, however equitable they may be. Doubtless the conditions in which public services are rendered by companies and corporations are different in the United States from those prevailing in this country, and it is conceivable that statutory control of the quality of gas would be imperative in a town in which the gas supply was in the hands of a corporation which monopolized the supply of coal, oil, electricity, and any and every other practicable source of artificial light, heat, and power. Such a "corporation" might be either a union or "combine" of different privately-owned supply undertakings, or a municipality or local authority; and in view of the tendency in some countries and districts to make light, heat, and power supplies a monopoly of the latter type of corporation, it is well that the State should assert its right to protect the public—*i.e.*, individual users—from the tender mercies of the corporate monopolist, by promulgating and enforcing controlling laws. But where a public service, such as that of gas supply, is rendered by a company working under some such provisions as those of the sliding-scale and in open competition with suppliers of electricity, coal, oil, suction-gas plant, and calcium carbide, the enactment and enforcement of testing and inspection provisions are likely only to hinder the gas consumer obtaining the most efficient and most econonical supply.

The material in the "circular" is arranged in three parts, of which the first gives a summary of the municipal gas ordinances now operative, presents a general discussion of municipal gas requirements, and proposes an ordinance which has been prepared as a compilation of the best ordinance requirements now in force, as determined by consultation with a considerable number of well-known gas engineers and inspectors. The latter "model" ordinance is, perhaps, the most interesting feature of the whole "circular." It is drawn up primarily for use in cities where the annual sales of gas are 500 million or more cubic feet, and modifications are suggested to adapt it for cities where the annual sales are between 500 and 50 million cubic feet, and for cities where the annual sales are lower than the latter figure. The ordinance comprises seventeen sections, some of which appear to us to be inflated with a superfluity of provisos and conditions calculated to suggest many loopholes to a legal luminary who may be called upon to advise as to ways in which the provisions may be evaded. We will endeavour to indicate as briefly as possible their scope.

Section I. defines the titles, names, and expressions used in the ordinance. Section II. relates to the appointment of a qualified and disinterested person as gas inspector; and Section III. to the appointment of similar persons as his deputies and assistants. Section IV. prescribes the duties of the inspector—the testing of the quality and pressure of the gas and the accuracy of gas-meters, the investigation of complaints, the keeping of complete and correct records of his work, the presentation of monthly reports, and the immediate notification of deficiencies of quality or pressure. The latter notification is to be made to the company by telephone or special messenger, and confirmed in a written report. Section V. states that the local authority shall provide, maintain, and equip testing-stations, to be if possible within between one and two miles of the gas-works, and the company shall run a special service-pipe to each testing-station. Section VI. gives some general provisions as to methods of testing, including representation of the company at testings, the use of standardized testing apparatus, and the definition that a cubic foot of gas means that volume under a pressure of 30 inches, at a temperature of 60° Fahr., and when saturated with water. Section VII. relates to the determination of the candle power of the gas, which determination is to be made at least once on every working day at each testing-station; the burner used being a Bray "No. 7 slit-union burner," or such other open-flame burner as may be agreed upon, the standard of light a 10-candle pentane lamp, and the photometer of the open-bar type. Section VIII. prescribes that the gas shall show a monthly average gross heating value of not less than 600 B.Th.U. per cubic foot, and a gross heating value on a single day of not less than 550 B.Th.U. per cubic foot. The determination of heating value is to be made at least once each working day at each testing-station by a calorimeter of approved form. Section IX. states that the gas shall not show the presence of sulphuretted hydrogen, and shall not contain more than 30 grains of sulphur, nor more than 5 grains of ammonia, per 100 cubic feet. The test for sulphuretted hydrogen is to be made daily, and the sulphur and ammonia are to be determined once a week.

Section X. prescribes that the pressure at the outlet of the service-pipe shall be not less than two nor more than six inches of water, and in one day shall not at any time exceed double the minimum pressure on that day. The determination of pressure is to be made by a continuously recording gauge at each testing-station. Section XI. deals with consumers' meters, which are to be tested by the company under the supervision of the inspector, and passed as correct if the error is not more than 2 per cent. They are to be re-tested within five years. Section XII. requires the company to keep records, open to the inspector, of (1) consumers and the number of each consumer's meter, (2) the life history of each consumer's meter, (3) complaints of quality, pressure, and accuracy of meters, and (4) gas-mains, service-pipes, and distributing plant. Section XIII. states that the company is to make reasonable investigation of all complaints, and to take steps to prevent the continuance of any deficiency in quality or pressure. Section XIV. gives the form in which penalties (the amount of which is left open) are to be fixed for infractions of the requirements in respect of (1) the daily average candle power, (2) the monthly average candle power, (3) the daily average heating value, (4) the monthly average heating value, (5) presence of sulphuretted hydrogen for three successive days, (6) excess above 30 grains of total sulphur, (7) excess above 5 grains of ammonia, (8) deficiency of pressure, (9) excess of pressure, (10) installation of an unsealed meter, (11) retention in use, beyond the prescribed time, of a sealed meter which has not been re-tested, and (12) keeping or disclosing the required records. Section XV. provides for the settlement of disputes as to testing by an arbitration board of three members. Section XVI. repeals previous ordinances inconsistent with this; and Section XVII. is to name the date when the ordinance is to come into force.

This summary shows that the rules which the Bureau of Standards considers suitable for a municipal ordinance constitute a formidable array. A footnote gives the comment: "The proposed regulations are not the most severe which could be enacted; but they are probably sufficiently rigid to offer good protection to the gas users under ordinary conditions of manufacture." The gas manufacturer may well be astounded at this revelation of the bureaucratic attitude towards an industrial company which has active competitors in all fields of its activity, many or all of which competitors are not hampered in their dealings with customers by similar regulations. Except when the gas undertaking is the property of a municipal or local authority, the gas consumer is now able to secure ample protection by mere force of appeal to the commercial enterprise of the gas manager and his board of directors. The Bureau of Standards does not appear to contemplate the enforcement of a similarly strict code of rules on gas-supplying local authorities. We are glad to observe that the Bureau does not express an opinion as to whether in any particular class of cities a candle-power or a heating-value requirement or both should be made. We are told: "Some cities require one, some require the other, and some require both." To which we may add, "and most cities (where the gas supply is in the hands of a company) require neither."

The further contents of this instructive "circular" will be dealt with in a subsequent issue of the "JOURNAL."

* Circular of the Bureau of Standards, S. W. Stratton, Director. No. 32. State and Municipal Regulations for the Quality, Distribution, and Testing of Illuminating Gas. First Edition, Issued April 1, 1912. Department of Commerce and Labour, United States of America. Washington, 1912.

In the course of the proceedings at the meeting of the Metropolitan Water Board last Friday, the Chairman (Mr. E. B. Barnard) announced that the King had consented to open the Chingford reservoir at a date to be fixed.

At the Farnworth Wesleyan Church, the marriage was recently solemnized of Mr. J. H. Davies, the Gas Engineer and Manager of the Oswaldtwistle Urban District Council, and Miss Edith Mary Robinson, only daughter of Mr. S. Robinson, the Managing-Director of the Widnes Foundry, and Mrs. Robinson, of "Leafield," Farnworth.

Before the Institution of Municipal Engineers, a discussion on "Water Softening" will be opened in the Council Chamber, 4, Southampton Row, W.C., to-morrow evening at half-past seven. Dr. J. F. Meyer will read some notes on the Permutit system, already noticed in the "JOURNAL," which is now being introduced into this country.

SOME OPPORTUNITIES FOR THE PRACTICE OF ECONOMIES IN GAS-WORKS.

[Communicated.]

In spite of the fact that a vast amount of good work has been done during the past ten years in the direction of introducing improved methods into gas-works, there yet exists very considerable room for improvement. The writer proposes to collect a list of a few of the most promising openings for effecting further economies in the process of coal-gas manufacture. The ideas mentioned are not new, but having been adopted in a few isolated cases only, they at least warrant consideration from gas engineers anxious to reduce the cost of manufacture.

That everything possible should be done to economize is especially desirable, as it is an acknowledged fact that the cost of coal is more likely to increase than to decrease. So much good work has been done in gas-works during the last decade, that it is fairly certain that the process of manufacture in all its branches will gradually be improved year by year. The pioneers of the continuous vertical retort system have done an infinite amount of good, and have shown, by comparison, how crude have been our methods in the past, and how much room there still exists for improvement. The writer proposes to deal briefly with the following list of suggested improvements:

I.—The primary air required for the furnaces of the retort settings should be heated, preferably in the presence of water, either by the hot coke after carbonization is completed, or by the waste gases.

II.—Retort-settings should be entirely lagged by a non-conducting composition to reduce the present heavy radiation losses.

III.—Every pound of steam required on a gas-works should be generated in boilers heated by the waste gases from the retort-settings.

IV.—No exhaust steam should be allowed to go to waste. All of it should be condensed and again used in the boilers.

V.—Nothing but clinkers and ashes free from combustible material should leave the works as rubbish, by which is meant that pan breeze and boiler ashes should be mechanically separated into fuel and ashes.

VI.—No ammoniacal liquor should be used for sulphate making or sold until it has been thoroughly saturated with carbonic acid and sulphuretted hydrogen in the washing and scrubbing plant.

VII.—Ammoniacal liquor should at the first opportunity (the sooner the better) be cooled to the atmospheric temperature to save the evaporation of the ammonia.

VIII.—Where ammoniacal liquor has to be transferred by road, rail, or water from works to chemical-works, it should first be concentrated to save freight costs.

IX.—Direct production of sulphate of ammonia by bringing the gas into contact with sulphuric acid, should replace the present system of sulphate making.

X.—Purification should be so improved that new oxide should absorb 50 per cent. of sulphur on each occasion that it is used in the purifiers, the burnt material being carefully prepared and again used.

The above may seem a formidable list of possible improvements; but in each case the suggestion is essentially practical, as has been actually demonstrated in one or more gas-works.

I.—Heating Primary Air.

It is obviously a great advantage to use hot primary air, provided that it is used in conjunction with steam. Economy in fuel consumption is gained, and by the intermixture with steam the only practical objection to the use of highly-heated primary air—that of overheated fire-bars—is effectually remedied. The admirable arrangement provided in the latest installations of the Woodall-Duckham vertical retort settings, in which the primary air is caused to circulate round the lowest portion of the retorts in an internal duct, is an excellent example of what can be done to heat both primary and secondary air by waste heat, either in the form of hot coke or waste gases. In this type of setting, the primary air is caused to pass over water-pans after being heated by the hot coke in the lower portion of the retort and immediately above the coke extractor. Thus hot air saturated with moisture is used in these furnaces. Such an arrangement is, of course, impossible with horizontal retort settings, and recourse must be had to the further utilization of the heat of the waste gases to heat both the secondary and the primary air. An enormous surplus of heat remains in the most efficient type of regenerator; so that no difficulty exists on this score. Types of settings have been designed to heat both the primary and the secondary air; but these have only been adopted in a few isolated cases, and without any great success. There is, however, an undoubted demand for a simple design of setting in which the primary air, as well as the secondary air, is heated by the waste gases. The writer does not intend this article to be anything but suggestive. Details of proposed methods, therefore, will not be attempted.

II.—Lagging Retort-Settings.

Year by year more engineers make a practice of lagging their retort-settings. Some have been particularly influenced in so doing by the greater comfort in which the men can work in front of the settings when a layer of slagwool, asbestos sheeting, or anti-thermic cement has been built in, or placed on the outside of the front wall. Others have looked to the fuel economy which must result from a conservation of the heat inside the setting. Whatever consideration has influenced the adoption of such methods of preventing the waste of heat, it is quite certain it is a desirable introduction. The writer, from practical experience, is convinced of its utility, and that expenditure on such a purpose yields more than 100 per cent. dividend every year.

The front walls of the settings and the top and end walls of each bench, should be covered, preferably within the walls, with 2 inches of the non-conducting medium. It will be found to make a very appreciable difference in the amount of heat radiating from the walls and top of the settings. It is impossible to put into figures the economy thereby gained; but it will be remembered that Professor Lewes, in his Cantor Lectures in 1911, stated that the radiation loss in a regenerative setting had been estimated to amount to about 20 per cent. of the total heat generated by the fuel. From an experience extending to some six years in the use of this material, the writer has come to certain definite conclusions as to the best means of using non-conducting composition; and he thinks that there is room for a good deal of improvement in the method by which it is applied to retort-settings. For instance, he has as yet seen no satisfactory method of attaching it to the outside of a wall without running the risk of its becoming detached if knocked and when shaken by the continual opening of retort-doors.

III.—Waste Gases for Steam-Raising.

Perhaps the most obvious source of economy in a gas-works is the use of waste gases from the retort-beds for raising steam. Why this is not a general practice is a matter for surprise, when it is considered that here lies an ample supply of heat for providing as much steam as can possibly be required. Not only would there be a large saving in boiler fuel, but there would also be a material reduction in labour. In most works the boiler plant is large enough to consume anything from 50 to 100 per cent. of the whole of the coke breeze and pan breeze made. Should water gas be made in any quantity, nearly all the breeze will be burnt. Considering that for every ton of coal carbonized there will be made something like 1¼ cwt. of breeze, it is really important that this should not be wasted in this manner. It might all be sold for about 6s. per ton—equivalent to 5·4d. per ton of coal.

What could be more simple than to place a boiler of suitable size between each retort-bench and the chimney, and cause the waste gases to circulate through the flues of the boiler before passing to the shaft? The addition of a bye-pass flue with damper would, of course, be necessary. It would also be advisable to make provision for firing the boiler in the usual manner should the retort-bench be under repairs. The use of a feed water regulator—and there are one or two excellent types on the market—would render the boiler to all intents and purposes automatic, requiring occasional attention only.

It will be remembered that Mr. Bernard F. Browne, in his paper read before the Institution of Gas Engineers last year, stated that the waste gases from regenerative settings capable of producing a million cubic feet per diem were sufficient, if passed through a boiler, to raise enough steam, at 75 lbs. pressure, to serve exhausters and pumps for 2 million cubic feet. He also stated that "they gave absolutely no trouble." This was his experience in Buenos Ayres. Who is going to be the first engineer to introduce this economical method of raising steam into English gas-works?

IV.—Condensation of Exhaust Steam.

Another economy which rarely receives any attention in gas-works is the condensation of exhaust steam. It is as wasteful to allow exhaust steam to blow out into the atmosphere as it would be to daily run large quantities of fresh water down the drain. It is even more wasteful, as the exhaust steam, if condensed, would provide the purest of water for use in the boilers. In up-to-date boiler installations, which, by the way, are never seen in gas-works, all the exhaust steam is condensed, and there is no reason at all why the smallest steam plant should not be provided with suitable condensing apparatus. It would be an excellent investment, saving very largely the fresh water required, reducing the wear and tear on boilers, saving fuel, owing to absence of scale, and reducing the amount of rust always to be found in the proximity of exhaust-steam outlets.

To carry out this suggestion, it is only necessary to collect all the exhaust steam-pipes into one common pipe. This pipe would be connected to an exhaust-steam oil separator, in which all the grease and oil, with the exception of an infinitesimal amount, is deposited. The steam is thereby purified and in a suitable condition for being condensed—a process which may be carried out in any convenient manner. The condensed water thus obtained should provide considerably more than half the feed water required. This is another source of economy in which the initial outlay should be recouped every year.

V.—Utilizing Pan Breeze and Boiler Ashes.

It is not so many years ago that pan breeze was looked upon as rubbish; in some cases, money was paid for its removal from gas-works. In more recent years, it has become a fairly general practice to screen it into a number of sizes, of which the largest is hand-picked for use as boiler fuel; the smaller sizes being sold at a low price for filtering material or for concreting purposes. Nowadays all this material may be treated in machines which,

by various mechanical means, separate the heavier material—*i.e.*, the clinkers—from the lighter (the coke). These machines have been for many years in general use in collieries for separating the dirt and dross from the coal; and it is only within the last few years that they have been adapted for use in washing and separating furnace pan breeze. Coke is so much lighter than clinker that it is not difficult to make use of the law of gravity for the purpose of effecting a separation. It may, therefore, be asserted that no gas-works of any size should send out from its gates as rubbish anything of a combustible nature.

VI.—Thorough Saturation of Ammoniacal Liquor.

Ammoniacal liquor is made in three parts of a gas-works plant: (1) In the hydraulic mains and foul main; (2) in the condensers and crude main leading to the washers; and (3) in the washers and scrubbers. It is the usual practice to run the liquor as soon as made into the common liquor storage tank. Where this is done, no advantage is taken of the purifying properties of the ammonia in the liquor. Undoubtedly the proper method is to collect the liquor made in the retort-house and condensers and circulate it through the washing and scrubbing plant. This liquor will there remove from the gas much of the sulphuretted hydrogen and carbonic acid that would otherwise pass forward into the purifiers. Liquor purification has so far been found to be impracticable, owing to the fact that there is made insufficient ammonia to neutralize the acid gases sulphuretted hydrogen and carbonic acid. This being so, it is at least distinctly advisable to use the ammonia in the gas to its fullest extent, as by its means the purification charges may be reduced. The gas may be improved both in lighting and heating power owing to the removal of much of the carbonic acid. By this means, all the liquor will be thoroughly saturated with carbonates and sulphides of ammonia before being removed to the sulphate plant or sold to the chemical-works.

VII.—Cooling Ammoniacal Liquor.

Ammonia is of so volatile a nature, and is so liable to evaporate where the temperature of the liquor is above that of the atmosphere, that it is a necessary precaution to maintain the liquor-tank at a low temperature. The ammoniacal liquor is made at a fairly high temperature; and unless some means are provided of cooling it, there will be a loss of ammonia wherever it is possible for it to escape into the air. In cases where all the liquor is made to circulate through the washing and scrubbing plant, it is an easy matter to cause the liquor to pass through a cooling vessel of some description before finally running into the storage tank. A coil immersed in water, or pipes cooled by the atmosphere, are all that are necessary to keep the liquor in store at a safe temperature. When it is considered that for every hundred tons of coal carbonized it is only necessary to cool from 3000 to 4000 gallons of liquor, it will be seen the matter is a comparatively simple one.

VIII.—Concentration of Ammoniacal Liquor.

The concentration of ammoniacal liquor is practised at some works where the cost of conveying it would otherwise be very heavy. This is especially the case when it is necessary to send the liquor by road or rail. Under such circumstances, provided that the liquor is sufficient in amount, there is money to be saved by installing a concentration plant. By this means it is possible to convert liquor of 8 oz. strength into liquor of 80 oz. strength, and thereby save 90 per cent. of the freight costs.

IX.—Direct Production of Sulphate of Ammonia.

The direct production of sulphate of ammonia by bringing crude gas into contact with sulphuric acid has been so far confined to coke-oven plants. There is, however, very little doubt that before long the process will be adopted in gas-works. The advantages are so obvious, and the economy to be gained by making sulphate of ammonia at low cost is sufficiently attractive, to render the system well worthy of adoption. The Burkheiser system, in which the ammonia and sulphur in the gas are ingeniously caused to combine to form sulphate of ammonia, is quite ideal, and goes further than any of the methods for bringing gas into contact with sulphuric acid.

A simple process for the direct production of sulphate of ammonia was described by Mr. P. C. G. Moon at the meeting of the Southern District Association of Gas Engineers and Managers in 1910. It was stated that the process was suitable for small gas-works; but the writer cannot comprehend why it should be confined to works of small dimensions. The process is simple and efficient, and in using it there is no necessity to bubble very hot gas into the acid, as in the Otto and Kopper systems—a very great advantage. More will certainly be heard of these methods of purifying gas from its ammonia, and, incidentally, producing sulphate of ammonia.

X.—Purification.

Purification by oxide of iron is already so cheap that one might well think that finality has been reached; but this is certainly not the case. In some works, and especially where new purifiers have lately been installed, the process has been brought to a high pitch of excellence. Let us first consider in what directions there is room for improvement. There is really only one, and that is in causing the oxide of iron to take up 50 per cent. of sulphur on each fouling. This has been done in isolated cases where the purifying plant is well arranged; but even then, such efficiency cannot be relied upon with anything like certainty. The reasons that this is so rarely done may be tabulated as follows: (1) The oxide cakes while still in an active state, and has to be removed owing to excessive back-pressure. (2) The oxide becomes inactive owing to (*a*) insufficient internal revivification, (*b*) the material becoming dry, (*c*) chemical causes, and (*d*) too low a temperature. Its removal may, of course, be rendered necessary for one or more of the reasons mentioned; and it is often found that the material on removal is defective in several respects.

The caking of the oxide may be most easily cured by adopting hurdle grids. The writer, though previously much troubled with back-pressure, has found that this type of grid effectually removes any difficulty in this respect. A comparison of the oxide on being removed from a purifier fitted with hurdle grids and one fitted with horizontal grids shows in a striking manner the advantages of the former. Instead of having the appearance of being compressed by weight, it is seen to be porous and open-grained, as a direct effect of taking the weight of the material in every part of the purifier. In the writer's opinion, all types of hurdle grids would have this effect, though some types have undoubted advantages in the matter of durability, initial cost, and the ease with which they can be removed when discharging the purifier.

As regards the other points mentioned, the easiest method to ensure proper revivification *in situ* is to daily collect a sample of clean gas—extending the sampling period over (say) 23 hours a day—and test for oxygen in an Orsat apparatus. Provided that a trace or 0·10 per cent. of oxygen is shown to be present, it may be inferred that sufficient air is being admitted. If more than 0·10 per cent. of oxygen is found, the air admitted should be reduced, and, similarly, if no oxygen is found the admission of air should be increased. Dryness of the material may best be cured by causing the gas to pass downwards, instead of upwards, through the purifier. If this can be done, the moisture condensed from the gas will soak into the material instead of running away through seal-pots, and thus the oxide is enabled to retain its normal quantity of moisture. Revivification *in situ* is liable, as a result of the heat generated by the oxidizing action, to render the material powdery and very dry. A downwards travel would cure this fault.

The chemical explanation of the inactivity of oxide is wrapped in obscurity; but it is known that unless some ammonia passes forward into the purifiers with the gas the oxide is liable to become acid, rendering it inactive and forming iron pyrites (FeS_2), which will not revivify on exposure to air. The most obvious precaution is to admit a little ammonia with the gas—say one grain per 100 cubic feet, and occasionally bye-pass some of the scrubbing-plant, should the oxide appear to be inactive.

The fault of attempting to purify gas with oxide of iron maintained at too low a temperature is universally recognized, and is especially noticeable in works where the purifiers are fixed in the open, and are uncovered by an enclosed building. The question is, Which is the cheaper method—to provide a building and pay interest and depreciation on its cost, or increase somewhat the yearly cost of purification? Probably, as regards £ *s. d.*, there is not much in it; and without a building, it is infinitely safer in the event of an escape of gas. In any case with purifiers fixed in the open, the temperature of the gas and the material may be very readily adjusted by fitting steam-coils under the bottom tier of the purifier. By this means, the temperature question may be effectually controlled.

Having, in this way, quite briefly discussed the principal causes which prevent oxide of iron from absorbing 50 per cent. of sulphur on each fouling, it may now be asked whether, if each point receives proper attention, this ideal state of efficiency could be reached. The writer considers that, given sufficient purifying area and assuming that the purifiers were worked on the reverse action system, there is no reason at all why the ideal mentioned should not be attained. In fact, in one or two recent instances where the purification has been carried on under the most advantageous conditions 50 per cent. of sulphur has been absorbed at one fouling.

In the case of burnt oxide, which is gradually being used in increasing quantities, it is known that the material is very liable to become acid in working. If this is found to be the case, the only remedy is to treat it with some alkali until the acidity is completely neutralized. Should this be done, most excellent results may be obtained with this material. The burnt material and its behaviour in working is a matter which has never been fully discussed, and is by no means generally understood. The fact of the matter is that some engineers are using burnt oxide which has been suitably prepared, and others are using it without any special preparation. The first-named are meeting with perfect success; while the latter are using it with varying results—sometimes satisfactorily, but often with complete failure. Why is this? The reason is that the proper method of preparing the material is only known to a few, who will not divulge their secret; while the reason for the varying results of those using the oxide without any special preparation is that the burnt material is in some cases accidentally treated in the correct manner on being removed from the oxide burners, or else it receives the treatment it requires after being placed in the purifier—that is, the ammonia admitted with the gas neutralizes the acidity of the oxide.

The whole question hinges on the fact that some burnt oxide requires one sort of treatment, some another. In some cases it gets all it requires accidentally; and in some cases it does not. The only certain method is to have it prepared by somebody who understands the subject, and who presumably will not give away his knowledge gratuitously.

SOUTHERN ASSOCIATION AT MITCHAM AND ELSEWHERE.

It was the day's outing of the members of the Southern District Association of Gas Engineers and Managers last Wednesday; and away from the daily routine, they unbent and gave themselves up to the delights afforded by a charming day, graceful hospitality, beautiful country, and the panoramic scenes presented by a trip, as a wind-up to the day, along the Thames from Hampton Court to Westminster Bridge. There was a sort of kaleidoscopic variety about the pleasures arising from the programme, for which the members were indebted to their genial, and because genial highly popular, President (Mr. B. R. Green, the General Manager and Engineer of the Mitcham and Wimbledon Gas Company), and to that embodiment of all that is essential and good in an Hon. Secretary of an Association of this kind (Mr. W. E. Price).

A start was made from Victoria Station at 11.25; and within twenty minutes the party was at Mitcham Junction, outside which were char-a-bancs waiting to convey probably eighty or so of Mr. Green's professional colleagues to the central scene of his daily work. We passed through parts of the old-world village of Mitcham, the nucleus of a large and popular residential district and hitherto known to some of the visitors only by the tales of its fairs, probably a closer acquaintance with the products of its lavender gardens, and possibly by—of course, a distant—familiarity with the historic Mitcham shag. The developments of the district in which the gas-works are situated (from which the prosperous borough of Wimbledon and much other area is also supplied) are reflected in the gas-works. At their gates, the visitors alighted, stopping to gaze before entry upon the splendid building serving as offices, and the lower part, facing the street, as a magnificent show-room equipped with all the modern apparatus with which the gas industry are speeding their business to greater ends. Inside the works, everything looked spick and span. Hosts and guests were soon being introduced to each other by the President. There was the Chairman, Mr. R. Garraway Rice, J.P., who has a hereditary interest in the Company; the family connection having extended so far back that we have no immediate means of ascertaining the date of its origin. An uncle of Mr. Rice's father was associated with the concern several decades ago; and Mr. Rice's father was a member of the Board, to which Mr. Rice himself was elected on his father's death. Now he is the Chairman; but he is also the colleague, in the fullest sense of the term, of his fellow-Directors and of the officers. With him were the Deputy-Chairman (Mr. George F. Page, J.P.), Mr. James Blachford, Mr. Robert M. Chant, J.P., Mr. Benjamin Green, and Mr. G. Clifton Sherrard. The professional friends of Mr. B. Green—father of the President—were glad indeed to see him among them again after his long illness and wonderful recovery. Later on Mr. H. E. Jones, the Chairman of the Wandsworth and Putney Gas Company, put in an appearance, having been able to escape from what he described (though he always looks cheerful in it) as the "dreary atmosphere" of the Committee rooms for the salubrious air of Mitcham. His appearance reminded that this was probably the last occasion on which a professional gas body would be able to be the guests of the Mitcham and Wimbledon Gas Company as such, before the interests of the Wandsworth, the Mitcham, and the Epsom Companies are all merged in one large concern.

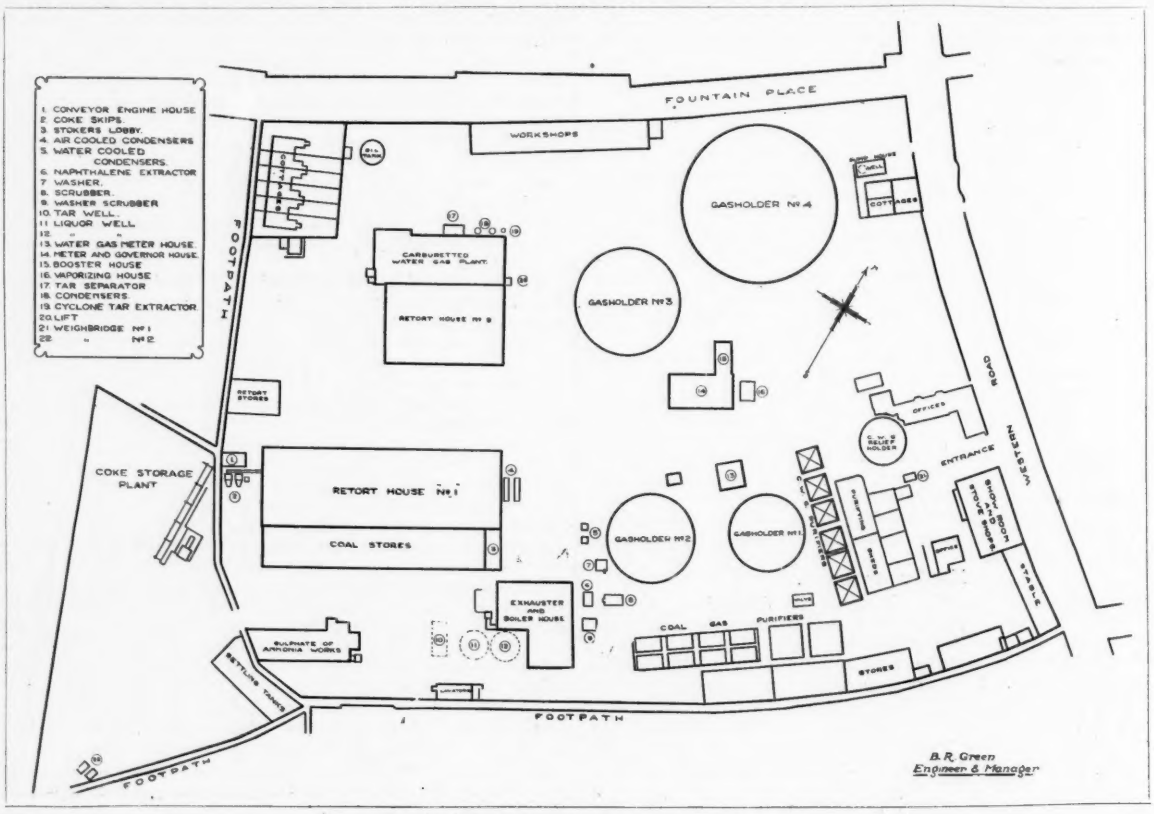
Round the Works.

However, it was a day in which the present and not the prospect was the thing that mattered. So after the individual personal welcome, the visitors, under the leadership of the President, with the Chairman and Directors mingled with the company, inspected the works—from coal-handling plant to gasholders. The professional eye, as it witnessed the coal being brought in by cart from the railway situated a little distance from the works, saw where the projected amalgamation holds for this district a future saving through the water carriage of coal to the Wandsworth works. The transmission of gas is cheaper than the transport of coal by rail; but that is something that is ahead as a matter of policy in the public interests. For some time to come, the Mitcham plant is good for a considerable amount of manufacturing work. We went through the retort-houses, looked at the carburetted water-gas plant, and examined the other plant in convenient order. In the exhauster, air-compressor, and pump room there was a stay of some little time, as there also was in the meter, valve, and governor room. Large and commodious places are these, and light; and here Mr. Green has shown how to have habitations for machinery that are good and pleasing for the eye to look upon, without any palatial extravagance. He believes strongly that such places, cleanly and fitted in a manner to be kept clean, has a good effect upon the men—encouraging cleanliness, heightening their feeling of responsibility, and stimulating care. In every quarter of the works, there dwelt the evidences of management, engineering, and initiative; and compliments drifted to Engineer and to Chairman and Directors, the latter of whom were pleased that the work of their chief executive officer met with such approbation from competent judgment. No one could help approving.

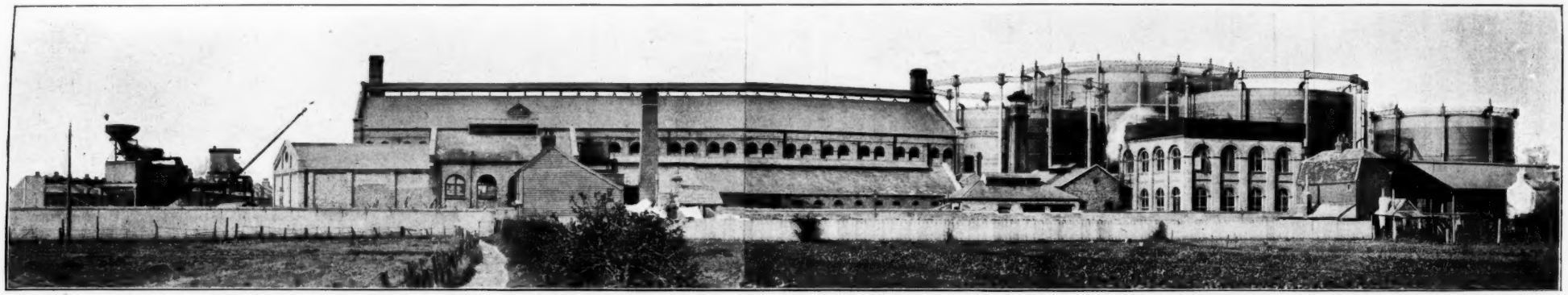
[A description of the works from the pamphlet prepared by Mr. Green and distributed among the members is subjoined to this general story of the day's doings.]

Luncheon on the Works.

At the close of the inspection, in a quiet grass-covered part of the Company's lands, the visitors were entertained, in a marquee, by the Chairman and Directors to lunch. Mr. R. Garraway Rice presided, having to his right-hand side Mr. H. E. Jones, and to his left-hand side the President of the Association (Mr. B. R. Green) and the Vice-President (Mr. H. O. Carr). The Deputy-Chairman and other Directors were interspersed with the guests at the top table. There were in all about 100 present; and before being seated they were welcomed in warm-hearted terms by the Chairman, on behalf of himself and his fellow-Directors. It was an



PLAN OF THE MITCHAM GAS-WORKS.



GENERAL VIEW OF THE MITCHAM GAS-WORKS FROM THE SOUTH.

excellent lunch for the excellent appetites that were the possessions of the visitors; and hosts and guests were all much gratified. Pleasure indeed abounded. After lunch,

The CHAIRMAN, following the toast of "The King," proposed "The Southern District Association of Gas Engineers and Managers." He said he hoped the members had enjoyed their visit to the works. As a member of Associations—archæological—having similar objects to their own, he could by comparison judge of their value. Such bodies were a means of making new and agreeable friendships, and of collecting information and knowledge. Where there was a community of friendships and interests, there was nothing that could draw men closer together. He could quite imagine that, when gas engineers visited the works of their professional friends, they were fired with the ambition of having some appliance or appliances that they saw there. He could well understand the Chairman and Board saying: "We wish that manager of ours would not go about so much. He is always asking for more money for something new." He (Mr. Rice) and his colleagues were thoroughly in accord with progressive engineers in keeping works well up with modern ideas. It was necessary to keep pace with the times. If they were not progressive, they must assuredly go back. He was one of those, too, who believed in competition. There was nothing of which he knew that gave one a greater incentive than when someone was trying to catch one up. This form of competition pushed them all forward. He hoped that the visitors had seen something that they liked that Mr. Green had got on the works. Now that the Company and the works had grown to a reasonable size, they were not opposed to experiment; but when a company was a small one, it could not afford to experiment. It was their duty, when in the position, to contribute so far as they could to the general progress. Regarding the Association, he believed and knew that it did a great deal of good. It did good to the members; and it did good to the gas industry. By seeing the members there, the Board hoped they were going to benefit the Company as well as giving their visitors a pleasant day. They hoped to get new ideas and thoughts, by which all things were started and forwarded, and the public were benefited. He wished success to the Association. He understood that it was extremely prosperous. Long might it continue so. He coupled with the toast the name of their President.

The PRESIDENT said this was one of the proud moments of his life. It had been his good fortune to visit, as a member of the Association, a great many works during his career; and he had noticed the very hospitable way in which the members were received on these occasions. He had often wondered whether he should ever have the opportunity of reciprocating in some small way the great kindness which had always been extended to him. Through the kindness, first of all, of the members of the Association in appointing him as President, and, secondly, of his Chairman and Board, he was able at last to reciprocate the kindness he had mentioned. There was no doubt as to the advantage of meetings of Associations similar to their own. They gave opportunities for discussing and suggesting various problems; and without such organizations those opportunities (he felt confident they would all agree with him) would be extinguished altogether. The opportunities for intercourse that the Association afforded were of individual and collective importance. He had to thank his Chairman, Mr. Garraway Rice, very heartily—and he (the President) was sure the members would wish him to do so—for the kind words he had spoken in proposing the toast. As an Association, they enjoyed a very proud position; and he hoped the position would long remain. He thanked all very much for the way the toast had been received.

Mr. H. E. JONES proposed: "The Mitcham and Wimbledon District Gaslight Company." He said he was sure all present would desire to join with him in thanking the management of the Company for their graceful hospitality—he might say sumptuous hospitality—they had extended to them, and for having met the members in the fashion the Chairman and Directors had done. As a member of the Association, he might say that it was to them very gratifying to find the management of a gas company take the enlightened view that Mr. Garraway Rice had done of the relations of such concerns with technical bodies. These organizations exercised a very beneficial influence upon the affairs of the industry; and it was therefore the duty of gas undertakings to encourage them, and to extend hospitality to them when occasion offered. When he left the dreary atmosphere of the Committee rooms at Westminster, he knew that he would find sun and fresh air at these works, and he had done so. The works looked nice and they smelled nice, as did all works conducted by such gentlemen as those who administered the Mitcham and Wimbledon Company. In their President, they had technical capacity; and this all would say who had had the opportunity of forming Mr. Green's close acquaintance, as he had been able to do in the last few months, during which he had been helping to work Mr. Green almost to death. Their friend had been following the path of his father, and had shown special ability, in the administration of this undertaking, the history of which could be found by consulting the pages of "Field's Analysis." Mr. Green and the Company were becoming, and were wishful of becoming, allies of another Company in the technical work of which the Vice-President of the Association (Mr. H. O. Carr) was concerned. Here again if they wished to know the merits and the history of the concern, and something of the history of Mr. Carr, they must look in the pages of "Field." He (Mr. Jones) was proud of having made the acquaintance of both these gentlemen. He was glad to know those pages of "Field" illustrated as much economic ability in the smaller gas companies as was shown in the case of the enormous neighbours that overshadowed them from their position alongside. It was almost to be regretted, in Mr. Green's personal interest, that his charge would become merged in the sister Company, and would not be separately run much longer. With the little Wandsworth Company, he (Mr. Jones) had been brought up. He had been connected with that concern since he was 17 years of age; and it was about to make a big expansion by amalgamation. The history of the Mitcham Company would show any reader that it had great potentialities; and Mr. Rice and his colleagues were convinced there would be public gain, and a saving of capital and other expense, by the scheme now before them. There was one other subject that came to mind. The gas industry had had a most extraordinary experience. It had emerged from a test and trial of an extraordinary kind. It had had its coal supply cut off for about eight weeks. Collieries were standing still for over six weeks, and for fully a fortnight more no coal was received by gas-works—in, at any rate, this part of the world. To his mind, this was a worthy record. It was no exaggeration to say that the gas undertakings of the kingdom had met this extraordinary and harsh trial with fortitude, endurance, and success. This showed that the public interests had been wisely safeguarded by men in the position of Mr. Green and Mr. Carr. It showed they had plenty in their stores; and they had assured the gas consumers from being without light and heat. The result showed the competence and courage of officers and staffs, who were minded to keep the flag flying at any sacrifice. Had it not been for what had been

done, large sums of money would have had to be spent in getting coal on emergency terms throughout the gas industry. Only one or two corporations had not succeeded quite so well as the companies; but with these exceptions, the gas industry had done well. He coupled with the toast the name of their estimable Chairman.

The CHAIRMAN, in reply, said that from what Mr. Jones had said, those present would have gathered that this Company would soon be standing in the position of a blushing bride, through their amalgamation with the Wandsworth Company. Mr. Jones had mentioned his long connection with the latter Company. He (the Chairman) should like to mention his long connection with the Mitcham Company. In 1849, it would be found from Mr. Green's notes, the Company was formed. His father's uncle was one of the Treasurers of the Company (whatever that official term meant); and his (the Chairman's) father was appointed a Director. It was one of his father's hobbies. He never succeeded to the chair, because he died in 1891. He (the Chairman) was appointed as his successor; and, in consequence of death and resignation, he followed the chairmanship of Mr. Stevens. Mr. Page, the father of the Deputy-Chairman, was also a Director of the Company. He thought they must all admit in the present day that if they wanted to be a success, they must be big. The scheme of amalgamation came at a time when Mr. Green and the Board were thinking of starting new works nearer the railway. Mr. Jones came to them and said, "We have at Wandsworth a lot of land near the Thames, and we are getting our coal in very cheaply, so that is a reason for the Companies joining up." There was a personal feeling that one liked to stick to one's own concerns; but the Board had to think what would be of benefit to the whole undertaking and the neighbourhood. He was convinced that it was absolutely to the benefit of all the companies that they should look favourably upon amalgamation, especially under the circumstances. If Mr. Jones had come to them a few months later, the circumstances might have been somewhat different. He had no doubt that they would all work together uncommonly well, and that what was done would be greatly to the advantage of the consumers. One thing that ought not to be forgotten was this: They had that day heard much of Mr. Green. He (the Chairman) knew the time when Mr. Green was not in existence; and when his father (whom they were so glad to see present that day) was Engineer and Manager. [Applause.] A good deal of the labour of these works had fallen upon the shoulders of Mr. Green, senior. After all was said and done, when they had good foundations in, they could build well on top. Much of the work of laying the foundations of this concern was done by Mr. Green, senior. He thanked Mr. Jones very much for his remarks in proposing the toast, and those present for their endorsement. The Company had been successful in the past; and he felt sure they would continue in the same way under the new order of things.

The PRESIDENT also acknowledged the kind words that Mr. Jones had employed regarding Mr. Carr and himself.

To Hampton Court, and on the Thames.

Soon after, the visitors, with their hosts, were again aboard the char-a-bancs and drove through varying scenes and charming spring-clad country to Hampton Court. *En route* they passed the show-rooms and offices of the Kingston-on-Thames and the Hampton Court Gas Companies. These are such close neighbours, that they must be mutually helpful.

At Hampton Court, the party embarked on a steam-launch, on which a little later tea was served. The trip to Westminster Bridge was greatly enjoyed. When nearing the end of the trip, the launch passed the Wandsworth Gas-Works, where flags were flying, and the Company's great collier the *Wandle* expressed its sincere delight, in a gloriously vociferous manner, at seeing the party. The compliment was reciprocated by, to the best of its ability, the smaller vessel occupied by the party. Westminster Bridge was reached shortly after seven o'clock; and after many adieus, the members took their divers routes.

DESCRIPTION OF THE MITCHAM AND WIMBLEDON GAS COMPANY'S WORKS.

In March, 1849, a meeting was held at Mitcham, when it was resolved that a Company be formed for establishing gas-works at Mitcham, to be called the Mitcham Gaslight and Coke Company, with a capital of £2500, consisting of 250 shares of £10 each.

In 1852, part of the Tooting district was purchased from the Phœnix Gas Company; the undertaking thus becoming the Mitcham, Merton, and Tooting Gaslight and Coke Company. It continued in this form until 1864, when the Wimbledon Gas Company was absorbed, and an amalgamated Company, termed the Mitcham and Wimbledon District Gaslight Company, was formed.

This Company received statutory incorporation and powers under a Special Act passed in 1867; and this Act continued practically without alteration as the basis of the Company's charter for thirty years.

There were in 1867 two manufacturing stations—one on a portion of the site of the present works at Mitcham, and the other on a piece of land (still the property of the Company) in Haydons Road, Wimbledon. Both these stations were in operation down to the year 1877, when the increased demand for gas rendered necessary considerable extension of plant. It was, therefore, determined to centralize the manufacturing portion; and new works of sufficient capacity to provide the whole output were erected at Mitcham, with the result that the Wimbledon station was shut down, and since that time the whole of the gas supplied has been manufactured at Mitcham. The gasholders at Wimbledon were used for a few years, but eventually, being found too small to be of service, were abandoned.

Further extension of the works became necessary as the district developed; but, before this could be done, adjoining lands, which had been acquired in the meantime, had to be scheduled for the purpose. Application was, therefore, made to the Board of Trade for a Provisional Order in 1892, which was duly granted.

In 1907, an Act of Parliament was obtained authorizing the Mitcham and Wimbledon District Gaslight Company to construct new works, to raise additional capital, and to convert their existing capital and for other purposes. The present paid-up capital of the Company is £335,594 4s. 7d. The price of gas is 2s. 8d. per 1000 cubic feet.

The Company's limits of supply comprise the parishes of Wimbledon, Merton, Morden, Mitcham, Tooting Graveney, part of Streatham, and part of Carshalton.

The following table gives an idea of the recent development of the undertaking:

Year.	Gas Made.		
	Total.	Amount of Increase.	Increase.
	Cubic Feet.	Cubic Feet.	Per Cent.
1901	281,521,000	..	..
1902	302,380,000	20,859,000	7·41
1903	311,182,000	8,802,000	2·91
1904	342,175,000	30,993,000	9·68
1905	379,400,000	37,225,000	10·88
1906	449,719,000	70,319,000	18 52
1907	525,041,000	75,322,000	16·77
1908	614,111,000	89,070,000	16·96
1909	693,744,000	79,633,000	12·96
1910	741,133,000	47,389,000	6·84
1911	816,381,000	75,248,000	10·15

There are at present:—

Total number of employees	462
,, ,, ordinary meters	10,755
,, ,, automatic ,,	21,017
,, ,, consumers	31,772
,, ,, miles of mains	154

Works, Area, and Output.

The works occupy an area of nearly ten acres, situated on a subsoil consisting of about 5 feet of gravel over the solid clay. As the railway is about half-a-mile distant, the imports to, and exports from, the works have to be carted.

The present manufacturing capacity is approximately:—

Coal gas	3,000,000	cubic feet per twenty-four hours.
Carburetted water gas	1,200,000	,, ,, ,, ,,
Total	4,200,000	,, ,, ,, ,,

The present maximum output for twenty-four hours is 3,174,000 cubic feet.
,, ,, ,, one hour is 304,000 ,,

Coal-Handling Plant.

The coal-handling plant is in duplicate, each portion consisting of a hopper (supplied by tip-carts) at the outlet of which is a regulated feeder which discharges across a screen into the breaker. The bye-passed and the broken coal fall to the elevator boot, and thence into the chain buckets, which lift the coal into the retort-house storage hoppers at the rate of 30 tons per hour. Each set of plant is belt-driven from its own gas-engine (26 B.H.P. and 18 B.H.P. respectively), fixed underneath the stage floor of the retort-house.

No. 1 Retort-House.

This is an extension of an old house which had direct-fired furnaces; the dimensions of the old structure being 168 ft. 6 in. long by 69 ft. 6 in. wide by 20 ft. high (to the eaves). By means of

Interior of No. 1 Retort-House.

steel framing, filled in with 4½-inch brick panelling, it was altered, in 1907, to the present dimensions—224 ft. 6 in. long, 69 ft. 6 in. wide, by 40 ft. high, on the stage-floor plan. On one side, running the full extent of the house, is a coal-store, in which is situated the coal-

handling plant previously referred to. This house contains two benches, each composed of eight and nine settings respectively, all on the regenerative principle. The settings are 20 feet through and 10 ft. 9 in. centre to centre of piers. Each setting contains eight horizontal retorts of oval ⌂ section, 22 in. by 16 in.—making a total of 136 retorts. The producers are arranged on one side only of the house, one to each setting. Both ends of each retort have 6-inch ascension pipes, which discharge the gas into separate hydraulic mains for every eight mouthpieces. Each bench has two retort-house governors and four tar-towers.

Coke-Gantry.

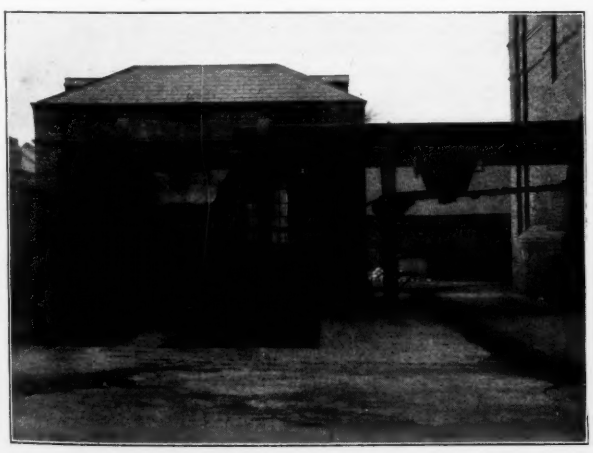
Charging and Discharging Machines.

On both sides of the house there is a 10-feet scoop-charging machine, and on one side a 20-feet telescopic ram-discharging machine, which discharges the coke either into the producers or on to the chain conveyor on the opposite side of the house.

The charging-machines are supplied from four overhead 50-ton hoppers; the two hoppers on one side of the house being fed by elevators, the two on the other side by belt conveyors across the retort-benches. The machines are operated by compressed air at 70 lbs. per square inch pressure. The charge of coal placed in each through retort is 9¼ cwt., which is worked off in eight hours. The hot coke on the conveyor is quenched during its passage through the house by water-hose jets, at 60 lbs. pressure, direct from a steam-pump.

Coke Plant.

Immediately outside the retort-house, but still at the stage floor level, the conveyor discharges the coke into one-ton skips, which have bottom opening doors. A 5-ton steam crane, travelling on an overhead gantry, picks up the skips and empties them either into the revolving screen fixed over the coke-storage hoppers, for



Discharge End of the Coke-Conveyor.

loading direct into carts, or on to the coke heap in the yard. The power for revolving the screen is derived from a small compressed-air motor. A 12 B.H.P. gas-engine drives the coke-conveyor, first through a belt and then through gearing which engages with the middle of the chain links. At the opposite end, just under the stage floor, is the tension gear.

No. 2 Retort-House.

This is 107 ft. 9 in. long by 69 feet wide, and contains four settings of sixes heated on the generative principle, and four settings of eights heated on the regenerative principle. The retorts are oval ⌂ section, 20 ft. long by 22 in. by 15 in. This house has not been worked for some considerable time.

Condensers.

Leaving the retort-house, the gas passes through two annular type air-cooled condensers, which are worked in parallel, thence through two vertical water-cooled condensers, worked in series—both gas and water being reversible. In this final cooling, as the reversal of the flow of gas is not sufficient to clear away the whole of the deposited naphthalene from the outside of the water tubes, carburetted water-gas tar, under a pressure of 70 lbs. per square inch, is sprayed into the top of the condenser, washing off the naphthalene.

Exhausters.

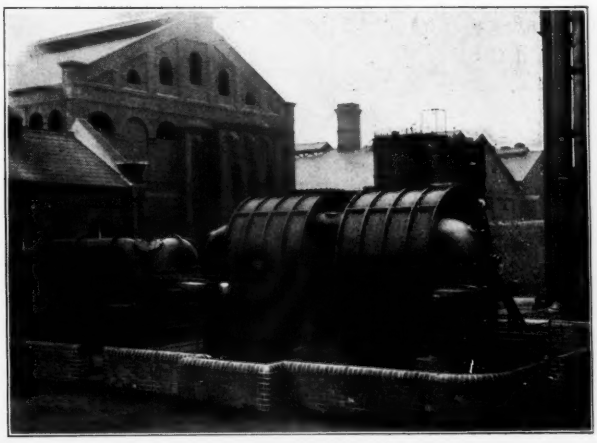
From the condensers, the gas passes to the exhausters. These are three in number. No. 1 has a capacity of 150,000 cubic feet per hour, and is driven by a 20 I.H.P. "Farey" compound jet-condensing steam-engine; the other two are each of 75,000 cubic feet per hour capacity, and coupled to another similar "Farey" engine, but arranged so that either may be driven separately, or both together.

Air Compressors, Pumps, &c.

In the same room as the exhausters, there are two 60 I.H.P. steam-engine driven air-compressors. These compress the air in two stages up to 70 lbs. per square inch, and automatically maintain this pressure in the air receiver in No. 1 retort-house. Also, in this room, there is a row of eight "Oddesse" patent duplex steam-pumps, for pumping water, tar, liquor, and boiler feed. Near these pumps is a small steam-driven exhauster, used for pumping oxygen through a rotary meter into the inlet of the purifiers, for the purpose of re-oxidizing the sulphided material.

Drawing Office, Laboratory, Photometer Room, &c.

Over the exhauster and pump room there is a drawing office, chemical laboratory, and photometer room; while above these are placed overhead tanks (35 feet above ground level) for storing 60,000 gallons of water and ammoniacal liquor for general works use.



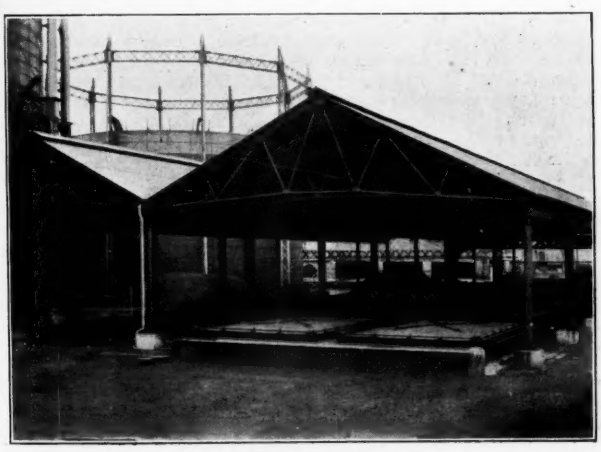
Washer-Scrubbers.

Washers, &c.

From the exhausters the gas passes first through a Livesey tar-washer, then through a Livesey washer containing carburetted water-gas tar, for absorbing any naphthalene remaining, and then through either a "Standard" rotary scrubber or a Walker vertical washer-scrubber for removing the last traces of ammonia.

Purifiers.

The purifiers are six in number. The first four purifiers are in one block, 120 ft. long by 30 ft. by 5 ft. 6 in. deep, with division



Coal-Gas Purifiers.

plates forming four 30 feet square boxes—each box having two covers. They are fitted with Milbourne's patent arrangement of 24-inch valves and connections, and Spencer's hurdle grids. Quantitative tests for sulphuretted hydrogen are made daily, showing the work done by each purifier; and at least once every twenty-four hours the fourth box in series is changed back into the first position. The remaining two purifiers are 30 ft. square by 5 ft. 6 in. deep, with plain grids and water lutes. They are connected to a Weck valve, and are used as catch-boxes. All are placed under an iron roof. The purifiers and revivifying sheds can be illuminated by 100-Hefner electric lamps; the wiring, &c., being enclosed in gas-tight tubing.

Syphons, Tar and Liquor Tanks, &c.

The various draining syphons round the condensing, scrubbing, and purifying plant are emptied in the following manner: In an old boiler tank, fixed on the ground level, a partial vacuum (20 inches mercury) is created by means of a steam-ejector. The connections of the syphons are then opened, so as to communicate with the vacuum tank. The draining liquor is thereby drawn up into the tank, from which it afterwards flows by gravity into the liquor storage wells. There are four underground tar and liquor tanks, having a total capacity of 250,000 gallons.

Meter, Valve, and Governor House.

Station Meter.

The coal-gas station meter, of 100,000 cubic feet per hour capacity, with 24-inch valves and connections, is placed in a room containing the valves and district governors.

Gasholders, &c.

The purified gas, after being measured, passes to a 36-inch diameter inlet cylinder, from which it goes to either of the four storage holders. These have a total capacity of 2,937,000 cubic feet, as follows:—

Number.	Diameter.	Depth.	Capacity. Cubic Feet.
1	70 feet ..	21 feet ..	215,000
2	82 ,, ..	22 ,, ..	315,000
3	99 ft. 8 in. ..	27 ,, ..	586,000
4	147 ft. 6 in. ..	36 ,, ..	1,821,000

All are in brick and puddle tanks.

The gasholder outlets are connected to a 30-inch diameter outlet cylinder, leading to the distributing cylinder, which is the common inlet to the three district governors—16, 18, and 24 inches respectively. An automatic bye-pass governor is fixed between the inlet and the distributing cylinders.

In the meter and governor room, a steam turbine-driven fan, of 350,000 cubic feet per hour capacity, is connected, so as to draw the gas from the inlet cylinder and discharge it into the distributing cylinder. This allows of pulling all the gas from the lightest holders, yet maintaining 9½ inches pressure at the inlet of the governors. In this room is fixed an electrically operated recording apparatus, which shows, on a chart, the daily pressure of gas in the centre of the Wimbledon district, three miles away.

Carburetted Water-Gas Plant.

This plant consists of two sets of 600,000 cubic feet, and one set of 800,000 cubic feet capacity each per day, in a steel-framed, corrugated iron building, with washers, scrubbers, water-cooled condensers, relief holder of 30,000 cubic feet capacity, two 40,000 cubic feet per hour Donkin exhausters, cyclone tar-extractor, six 20 feet square oxide purifiers, and a 60,000 cubic feet per hour station meter.

There are two Sturtevant fans, belt-driven by high-speed compound steam-engines, and one direct coupled turbine fan giving an air-blast of 20 inches pressure on the generators. The coke is elevated to the stage floor by a hydraulic lift.

There are three Lancashire boilers—one 24 ft. by 7 ft. 6 in., the other two 30 ft. by 7 ft. 6 in. All are fitted with Meldrum's forced-draught furnaces, and give a steam pressure of 125 lbs. per square inch.

The carburetters and superheaters are fitted with Bristol's pyrometers, connected to two indicators on the stage floor. In the engine-room is a smoked chart recorder, arranged so that either indicator may be switched on, to obtain a record of the indicated temperatures when desired.

Carburetted Water-Gas Plant.

There are also in the engine room direct-acting duplex steam-pumps for supplying oil, circulating water, condenser cooling water, 10-ton hydraulic accumulator and boiler-feed. The latter passes through one of Wright's patent feed-water heaters.

The cooling water for the condensers is pumped from a gas-holder tank, and is re-cooled, by passing through spray nozzles, on its way back to the tank.

Storage is provided for 150,000 gallons of oil.

The purified carburetted water gas, after leaving the station meter, passes to the inlet cylinder in the governor room (previously mentioned), where it mixes with the coal gas and passes thence to the holders.

Workshops.

Near the carburetted water-gas plant, workshops are provided for machine repairs, &c., blacksmiths, carpenters, and lamp repairs. The machine shop contains the following: A 2¼-inch diameter main shaft, running in Hyatt's patent roller bearings, a 7 in. by 7 ft. and a 6 in. by 6 ft. lathe, a 3 feet radial drill, a sensitive drill, 21-inch shaping machine, 2-inch and 4-inch pipe-screwing machines, a grindstone, a twist drill grinder, a hacksaw, and a shearing and punching machine.

The blacksmiths' shop contains four forges, each connected to a fan for supplying the air-blast, and another fan for removing smoke, &c.

Another set of shops, near the works entrance, is provided with the necessary apparatus for cleaning and repairing cookers, fires, meters, &c., used on the district. In these shops is fixed a 27-ampere 100-volt electric generator for lighting the purifier-sheds, and the meter and governor room.

Sulphate Plant.

The sulphate of ammonia plant was supplied by the Chemical Engineering Company, and is capable of producing 5 tons a day.

Water Supply.

The water supply for the works is derived from an artesian well, 375 feet deep, by a three-throw pump driven by a gas-engine.

Future of Electricity.—Towards the close of a discourse at the Royal Institution, by Mr. Alan A. Campbell Swinton, on "Electricity Supply: Past, Present, and Future," he spoke as follows on the future of electricity: "No doubt the future of electricity supply lies with very large stations employing very big units of plant, and combining the generation of electricity with chemical manufacture—the electricity on the one hand and the chemicals on the other being bye-products each of the other's manufacture. So far as this country is concerned, for electricity supply at all events, we are not likely to depart from the use of coal so long as that source of energy holds out. For the propulsion of ships oil may present advantages, but on land in Great Britain coal must remain the cheaper. In all probability, however, in the future the coal will not be simply burnt. It will be turned into gas, and the sulphate of ammonia and the tar, with all its interesting constituents, saved. Whether the gas will be burnt under boilers for the raising of steam to supply steam-turbines, or whether it will be used in internal-combustion engines, will depend on the progress made by the latter in regard to attaining larger dimensions, and also as regards improvements in the gas-firing of boilers, in respect of which, as has recently been shown by Professor Bone in his interesting lecture on 'Surface Combustion,' there is still much to be done."

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Oldham.

On the occasion of their visit to Oldham on Saturday, members of the Institution were favoured with very fine weather; and there was a large attendance—about eighty being present. In the early part of the afternoon, an inspection was made of the new spiral-guided gasholder in course of construction at the Hollinwood works of the Corporation; the party subsequently returning to Oldham by tramcars provided by the Tramways Committee.

Mayor's Welcome.

The Business Meeting was held in the Council Chamber at the Town Hall—Mr. Samuel Glover, of St. Helens, the new President, being in the chair.

Before the *agenda* was proceeded with,

The Mayor (Councillor F. G. Isherwood), who was supported by Alderman Herbert Wilde, the Chairman of the Gas Committee, extended a cordial welcome to the members, and expressed the hope that they would have a profitable business meeting. He pointed out that there is to-day competition between gas and electricity; and he expressed the opinion that, if gas engineers were to hold their own, they would have to be "up and doing." For himself, he thought there was a great future before them—a great future for gas and electricity. There was room for both; but it would depend upon how those who had to supply them made use of their respective opportunities, which would eventually become the leading and paramount lighting institution of this country.

On behalf of the members, the President thanked the Mayor for the hearty welcome he had extended to them.

Among the letters of apology read by the Hon. Secretary (Mr. W. Whatmough, of Heywood) for inability to be present at the meeting, was one from Mr. R. G. Shadbolt, the President of the Institution of Gas Engineers.

Education of Gas-Fitters.

The final report of the Committee on this subject, signed by the President (Mr. Glover) and the Hon. Secretary (Mr. E. H. Hudson), was read by Mr. Whatmough, in the unavoidable absence of Mr. Hudson. It was as follows:—

> We have to report that the scheme for the education of gas-fitters, submitted to the members at their last meeting, and confirmed, has been approved by the following Associations, and in no single instance has there been any expression of opinion antagonistic to the scheme:
>
> Manchester District Institution of Gas Engineers.
> Southern District Association of Gas Engineers and Managers.
> North of England Gas Managers' Association.
> Midland Association of Gas Managers.
> Irish Association of Gas Managers.
> Wales and Monmouthshire Institution of Gas Engineers and Managers.
> Society of British Gas Industries.
> Ironmongers' Federated Association.
>
> Your Committee therefore submitted the scheme to the Council of the Institution of Gas Engineers at their meeting on the 17th of April last, and are glad to report that it was approved without emendation, and will in due course be presented to the members of the Institution of Gas Engineers at their meeting in June next.

Mr. R. Watson (Doncaster), in moving the confirmation of the report, and expressing the thanks of the Institution to Mr. Hudson for his labours in connection with the matter, said it must be a source of gratification to them all that their scheme had been accepted by the Institution of Gas Engineers, and had also received the approval of so many kindred Associations.

Mr. H. Kendrick (Stretford) seconded the motion; and it was carried unanimously.

The President remarked that the scheme would now go forward, and no doubt result in something practical being done.

The Death of Mr. Timmins.

The President, referring to the recent death of Mr. Joseph Timmins, of Wigan [see *ante*, p. 422], said he was one of the oldest members of the Institution, and a man who was highly esteemed by all, not only as a gas engineer, but for his personal qualities and high character. The Institution was represented at the funeral by himself as President, Mr. Whatmough, the Hon. Secretary, and several other members. He (Mr. Glover) thought that, in addition, they ought to send a letter of condolence to Mrs. Timmins and the family; and in approval of this, and as a mark of their appreciation of their deceased colleague, he asked members to rise in their places.

This was done; and the President intimated that the letter of condolence would be sent by the Hon. Secretary.

Spiral-Guided Gasholders at Oldham.

Mr. T. Duxbury (Oldham) then read a paper on this subject. It will be found, with a report of the discussion, on p. 510.

Votes of Thanks.

On the motion of the President, seconded by Mr. E. Allen (Liverpool), a vote of thanks was passed to Mr. Duxbury.

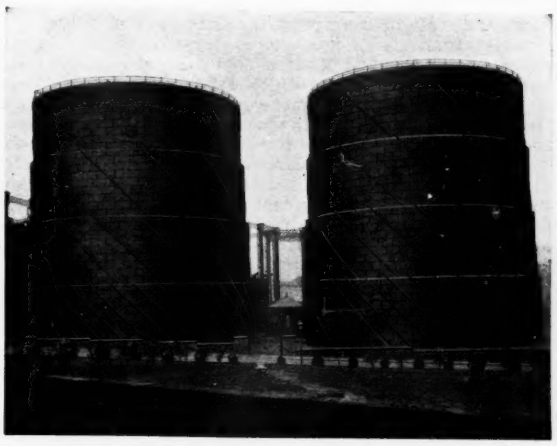
A vote of thanks was also accorded to the Mayor of Oldham, the Chairman of the Gas Committee, and the Corporation, for the facilities given for the visit of the members to Oldham; the mover being the President, and the seconder Mr. R. Watson.

Alderman Wilde responded. In the course of his remarks, he expressed the hope that the members had benefited by their visit, and by what they had seen at the Hollinwood works. He said the Oldham Corporation were proud of their gas-works, and they were also proud of their Manager.

This concluded the proceedings. Subsequently the members had tea together in the banqueting-room of the Town Hall.

SPIRAL-GUIDED HOLDERS AT OLDHAM.

Particulars are given in the course of the paper read on Saturday by Mr. T. Duxbury before the Manchester District Institution of Gas Engineers [see p. 510] of the spiral-guided holders in use at the Oldham Corporation Gas-Works. The accompanying photograph shows the two converted holders at the Higginshaw station.



Spiral-Guided Gasholders at the Higginshaw Works.

These, it is stated by Mr. Duxbury, have been enlarged from two-lifts with guide-framing, to four lifts on the spiral-guided system; the capacity of each being thereby increased from 400,000 to 780,000 cubic feet. The holders are only 100 feet diameter in the outer lift; and each of the four-lifts is 29 feet deep. There are, however, 36 sets of anchor bolts and 36 spiral rails on the outer lift; and Mr. Duxbury expresses the opinion that with this number of anchor bolts even a greater height would be safe. In fact, when the question of converting the next 100-feet diameter holder arises (those already converted are two of a group of four), he will be prepared to consider five lifts (or a total height of 135 feet), if the holders now working give every satisfaction after standing the test of time. The illustration was supplied by Messrs. R. Dempster and Sons, of Elland.

Long Service with the Bolton Corporation.—Mr. James Parker, the Superintendent of Gas Lighting for the Bolton Corporation, who has just attained his eightieth birthday, has completed fifty years' service with the Gas Department. He commenced as an ordinary lamplighter, was made foreman in 1873, and superintendent in 1882. When he first took up his duties, there were in the central district of the borough 1701 lamps and 18 lamplighters; whereas now the numbers are 3042 and 36 respectively.

Directory of Gas Undertakings for 1912.—We have received from Messrs. Hammond and Co., Limited, of Birmingham, "The Gas Engineer's Annual," with directories of gas undertakings and gas industries, and a gas-works daily journal for the current year. The latter are preceded by a literary section, which contains a review of the proceedings at the Glasgow meeting of the Institution of Gas Engineers, and some notes on the career of the President for this year, Mr. R. G. Shadbolt, whose portrait is given as a frontispiece. The first two directories deal with gas undertakings in the United Kingdom, and those in the British Colonies which have offices in London; and the third contains a list of engineers, contractors, coal owners, &c. The towns are arranged in alphabetical order, and the statistical and other particulars furnished include the names of the manager and secretary of the undertaking, the quantity of gas sold, and the price, &c. The daily journal (which, with the directory of industries, is a new feature) is arranged for recording working results. This is the thirty-third edition of the "Annual," and, as hitherto, it is edited by Mr. Charles W. Hastings. The price is 3s.

SPIRAL-GUIDED GASHOLDERS AT OLDHAM.

By T. Duxbury, Gas Engineer, Oldham Corporation.

[A Paper read before the Manchester District Institution of Gas Engineers, May 18.]

It was my intention to have read a paper on the construction of the concrete tank at Hollinwood. But the Secretary informed me that the present time would be opportune for a short paper on the Gadd and Mason system of spiral-guided holders; and this paper is written with a view to providing an opportunity for discussion and for obtaining opinions from those engineers who have had many years' experience of the system. Latterly, I seem to have been attacked with "spiral fever," for within two years we have erected four four-lift spiral-guided holders in Oldham, each of which has some novelty. For instance, the one at the Hollinwood works is by far the largest holder of this kind ever erected; the two at the Higginshaw works are greater in height than in diameter; and the one at the central works, though its height is almost equal to its diameter, has round the outer lift only 20 spiral rails, as against 36 at Higginshaw.

There are in all twelve gasholders at Oldham, seven of which are column-guided to their full height, one has a flying lift, one is rope-guided, and three are spirally-guided. Within the past seven years, six holders have been re-sheeted, and opportunity has been taken to increase the storage capacity at the same time. Therefore five holders have been taken out entirely, except the interior framing, and enlarged from two lifts to three or four lifts.

The storage capacity previous to these enlargements was 6,020,000 cubic feet, while the maximum delivery in one day was 8,600,000 cubic feet. The present holder capacity is 7,420,000 cubic feet; so that by enlargement space for 1,400,000 cubic feet has been added. And though the cost per 1000 cubic feet amounts to about the same as building a new tank and holder, we have the valuable land left for other gas-works purposes. By continuing this policy, we can still further increase the storage by more than 3 million cubic feet, or 40 per cent. above our present storage, when the time comes for re-sheeting other holders. We have already added eight lifts, each 100 feet diameter, and nine more can yet be put up.

At our Higginshaw and central gas station, which are so connected as to assist each other in supplying Upper Oldham, the storage capacity is 5,220,000 cubic feet, and the maximum daily output is 4,728,000 cubic feet; but at the Hollinwood works, which cannot receive assistance from the others, the maximum daily delivery is 3,633,000 cubic feet, and the holder capacity is only 2,200,000 cubic feet. Hence the need for the 5¼ million spiral holder which is in course of erection, and will be ready for work this autumn. This will bring our total holder capacity to 12¾ million cubic feet, when we shall be in a much more comfortable position for meeting the necessary requirements of the 500 works and mills in foggy weather. At the present time, when the mills are fully lit, the delivery of gas is 750,000 cubic feet per hour; so that our total storage is less than ten hours' mill supply in case of a strike or sudden stoppage of the works, and at Hollinwood we have only seven hours' supply.

General Features of the Spiral-Guided Holder.

It is now some 24 years since Mr. William Gadd patented the system of spiral-guided gasholders; and every credit is due to him for the complete revolution in the scientific and practical method he adopted for dispensing not only with the first cost, but with the upkeep of column and girder guide-framing. The more gas engineers study the cantilever principle of Mr. Gadd's patent, the greater must be their confidence in this method of guiding. I am only a new convert, but I have now every confidence in spiral-guided gasholders, believing that, when properly designed, it is almost impossible for them to tilt or blow over. I would here quote the opinion of one of our most capable gas engineers, the Treasurer of this Institution, our old friend Mr. Thomas Newbigging, in a paper read before us in August, 1888, prior to the erection of the first spiral holder:

> So long as the rollers are free to move within the guides, it is impossible that the holder can tilt so as to get out of the vertical; the tendency of wind or other pressure exerted against the sides or on the roof of the vessel being to produce what may be described (imperfectly, however) as a locking action, which will sustain the holder in the upright position, however great the strain, within the resisting strength of the rollers and their carriages. Whilst this locking or gripping action gives rigidity to the vessel, enabling it to resist the overturning force, the rollers are perfectly free to rise and descend within the guides.

The locking action here referred to is not, I take it, the locking action we have heard so much about lately, but merely that the whole of the rails and rollers would be put in gear together, and withstand any deviation of the holder from the horizontal, still leaving it free to rise or fall in the usual way. This opinion, which was formed before a single spiral-guided holder had been erected, shows the sound engineering judgment we have always found in Mr. Newbigging.

Within eighteen months after the expression of this opinion, Mr. Newbigging demonstrated his thorough belief in the system by being the first engineer to erect a spiral-guided gasholder (for the Northwich Gas Company); and our old friend Mr. Samuel Mellor, the Engineer, informs me that, though in some respects it may be out of date, they have never had a single mishap, nor has it cost them anything for renewals or alterations during the whole twenty-two years. I am fully convinced that the confidence of Mr. Gadd and Mr. Newbigging in the system has been fully justified and clearly proved, as probably more than 300 spiral-guided holders have been erected; and I should say that 90 per cent. of the new holders put up in this country at the present time are of this type. There are now several improvements upon the Northwich holder, probably the most important being that the guide-rails and rollers, which were then fixed in inaccessible places inside the holder, are now placed outside and are readily accessible; also the rails are usually fixed to continuous plates instead of to the thin holder sheeting, about which I shall make some remarks later.

As gas engineers know, the spiral-guided holder is constructed on the principle of a screw working in a nut; the rails of the holder forming the thread, and the carriages on the dips of the different lifts and around the tank wall forming the nut. As only just sufficient play is allowed, in the fitting of the rails and rollers, to ensure good work in addition to the allowance for radial expansion due to differences in temperature, it follows that no part of such a holder can lift to any appreciable extent more than any other part. The whole of the carriages around the tank tend to resist any overturning action, because all the rails are in contact with the carriages round the tank at the same time; that is to say, during a gale half the number of rails—viz., those on the windward side—are bearing upwards against the rollers, and the remaining half, those on the leeward side, are bearing downwards on the rollers when the wind is tending to overturn the holder. At all heights of the holder the rollers grip the rails, and thus establish what is practically a rigid connection with the tank sides.

In some cases more rails are fixed on the inner lift than are really necessary for strength; but it appears to be a custom not to fix the rails more than 35 feet apart. At the same time, it is much more convenient, in putting the holder together, for the rails on each lift to be some multiple of the rails on each of the other lifts; and in the case of existing tanks, where the existing holding-down bolts are to be used again, this will determine the number of rails or the multiple of rails to be fixed to the outer lift.

For the successful working of a spiral holder, it is essential that the rotary motion should be accomplished with absolute freedom of action, so that there is no possibility of increased pressure being thrown by the holder at any point of its rise or fall owing to undue friction between the spiral rails and the rollers; that is to say, the dimensions from the centre line of the holder to the centre of the rail-flange gearing with the rollers should be the same from top to bottom of each rail. To achieve this object successfully, the rails are laid on a perfectly level and rigid surface, so that instead of fixing them on to the thin sheeting of the holder, as was originally done, they are now riveted on to a mild steel diagonal plate, about 12 inches wide, generally extending in one length from top to bottom of the holder; the plates and rails being fixed at an angle of 45 degrees. By using this plate, all joints and rivets behind the rail are avoided, so that it is unnecessary to countersink rivets on the thin sheeting of the holder behind the rails, where it will be readily understood any leakage would be very difficult to make good.

These diagonal plates also add materially to the strength of the holder, for not only do they, but also the spiral rails, act as extra stiffeners to the holder; for, being fixed at an angle of 45 degrees, and the interior stays being fixed vertically, the two combine to form a kind of lattice bracing all round the sides of each lift. Consequently the bell of a spiral-guided holder is stronger than a column-guided bell, notwithstanding that the vertical stays and sheeting may be of somewhat lighter section. In other respects, spiral-guided holders are constructed in a similar manner to those which are column-guided.

A word may here be said as to the safety of spiral-guided holders generally. Whatever differences of opinion there may be on this point, it must be conceded that this system has long since passed its experimental stage, seeing that it is twenty-two years since the first one was erected; and I am not aware that during the past ten years there have been any more accidents to spiral-guided holders than to the ordinary column-guided ones, due to the principle of construction.

The Spiral-Guided Holders at Oldham.

Higginshaw.

The first spiral-guided gasholder at Oldham was erected in the summer of 1910, when tenders were obtained for: (1) Re-sheeting an existing two-lift holder; cutting down the interior crown framing and refixing it in the tank to support the holder when at rest; adding two lifts inside the existing two lifts; and raising the cast-iron columns to the extent of one more lift, with allowance for the inner lift to rise out free of the guide-framing. (2) For taking down the columns and girders, clearing away the whole of the existing two-lift holder except the crown framing, which was to be cut down and refixed in the tank as before, and substitute a new four-lift spiral-guided holder. The difference in cost between the two systems was £1679, or upwards of 20 per cent. in favour of the spiral-guided system.

Then came the question of deciding which system to adopt, inasmuch as the outer lift was only 100 feet diameter, and the four-lift holder, when fully inflated, would be 108 ft. 6 in. high to

the top curb. The question arose of taking the risk and saving £1679. As this holder is one of a group of four, and the method of converting the remaining three holders would depend upon the satisfactory working of the first one (one more holder has since been converted in a similar manner), the ultimate saving would be £6716, which is equivalent to the total cost of enlarging another holder of 750,000 cubic feet capacity.

After carefully considering the practical and scientific construction of the spiral-guided system, I came to the conclusion that we might safely adopt it if we fixed sufficient spiral rails to the outer lift. The column base-stones and the holding-down bolts of the 12 existing columns were utilized for the main anchor plates; and I decided eventually, instead of fixing only one set of intermediate anchor bolts between each pair of existing piers, to fix two sets. There are therefore 36 sets of anchor bolts and 36 spiral rails on the outer lift, instead of the 24 originally intended. I am of opinion that, with this number of anchor bolts, even a greater height would be safe; and when the question of converting the next 100 feet diameter holder arises I shall certainly be prepared to consider five lifts—that is, a height of 135 feet—if meanwhile the holders now working give every satisfaction after standing the test of time.

As I have previously stated, since the first holder at Higginshaw was erected on this system, another has been similarly converted. Each of these holders is 100 feet diameter in the outer lift, each having four lifts 29 feet deep, and each had 12 columns, the distance centre to centre being about 27 feet; and while, perhaps, I have more strength than is absolutely necessary by fixing two intermediate sets of anchor bolts between every two existing piers, I have preferred to err on the safe side, thereby having the satisfaction of feeling there is a big factor of safety, which, after all, is not a bad fault, considering the height of the holders.

In both these cases, as the tank walls are forty years old, it was not advisable to disturb the brickwork any more than was absolutely necessary, for fear of leakage, as trouble had been experienced previously. Therefore the front set of bolts were hooked into the existing face of the wall 8 ft. 6 in. down, and protected from direct contact with the tank water by cast-iron shields filled in with concrete. The back bolts were securely hooked into the outside of the existing wall without cutting far into the wall; the puddle having been removed to enable this to be done. The bolts were then bedded in a block of concrete, after which the clay puddle was reinstated and thoroughly kneaded-in with the surrounding puddle, which had been left undisturbed.

These two holders, each enlarged from two lifts of 400,000 cubic feet capacity to 780,000 cubic feet, are of the following size:—

	Diameter. Ft. In.	Depth. Feet.	Spiral Rails.	Distance Apart. Ft. In.
Inner lift	92 0	29	8	36 0
Second ,,	94 8	29	12	24 9
Third ,,	97 4	29	18	17 0
Outer ,,	100 0	29	36	8 9
Tank	102 0	29	—	—

Total number of spiral rails, 74.

The tank and dip carriages throughout are of Siemens mild steel fitted with gun-metal bushes, in which work the steel pins, varying in diameter from 3¼ inches for the two outer lifts to 2¾ inches diameter for the third lift, and 2¼ inches diameter for the inner lift.

Central Works.

In the case of the central works, the holder had only ten column piers around the tank walls; the distance centre to centre being 32 feet. The outer lift is 100 feet diameter; and the total height of the new holder, when fully inflated, is 88 ft. 6 in. to the top curb. One extra set of anchor bolts was fixed between each pair of existing holding-down bolts in this case, in a similar manner to that described for the Higginshaw holders; thus making 20 sets of spiral rails on the outer lift of the holder—these being sufficiently strong for the height of the holder.

The size of this holder and the number of spiral rails are as follows:—

	Diameter. Ft. In.	Depth. Feet.	Spiral Rails.	Distance Apart. Ft. In.
Inner lift	92 0	24	10	28 9
Second ,,	94 8	24	15	19 9
Third ,,	97 4	24	20	15 3
Outer ,,	100 0	24	20	15 8
Tank	102 0	25	—	—

Total number of spiral rails, 65.

In this case, the axles for the carriages working on the outer lift are 3¼ inches diameter; those on the next lift, 2¾ inches; and those on the two upper lifts, 2¼ inches. All carriages are of Siemens mild steel plates, with gun-metal bushes.

Hollinwood.

The new spiral-guided holder now being erected at the Hollinwood works is also of four lifts, with a capacity of 5,360,000 cubic feet. The size of this holder and the number of spiral rails are follows:—

	Diameter, Ft. In.	Depth, Feet.	Spiral Rails.	Distance Apart. Ft. In.
Inner lift	202 6	40	20	31 9
Second ,,	205 0	40	30	21 5
Third ,,	207 6	40	40	16 3
Outer ,,	210 0	40	60	11 0
Concrete tank	212 0	41	—	—

Total number of spiral rails, 150.

As this holder stands 5 feet above the surrounding ground level when fully inflated, the height from the ground line to the centre crown plate will be 176 feet, which is equal to the height of a modern mill chimney. The height from the water-line to the top curb will be 154 feet.

All carriages are of Siemens mild steel plate, with gun-metal bushes and steel pins 3¼ inches diameter on the two outer lifts, 2¾ inches on the next lift, and 2¼ inches for the inner lift. All rollers are of cast steel; the groove being specially turned out to grip the front flange of the rail. The tank anchor bolts—four to each base-plate—are 2 inches diameter and 8 ft. 8½ in. long.

On all four spiral-guided holders, the side sheeting of each lift has been made to project 3 inches above the top curb and the dip channels, except a small portion on the right-hand side of each spiral rail, which is cut away to the level of the curb and dip channel, so that any overflow of water can only get away from the crown or cups by running down the rail; thus preventing the holder from being unequally streaked with dirt, and prolonging the life of the painting.

Economy of the System.

Respecting the capital cost of spiral-guided over column-guided holders, there is a decided advantage in favour of spirals. In the case of the first holder at Higginshaw, having a capacity of 780,000 cubic feet, the average of six tenders was as follows: For raising existing cast-iron columns and adding two lifts, one of which is a flying lift, £7837, or £10 1s. per 1000 cubic feet; for a four-lift spiral-guided holder, £6158, or £7 18s. per 1000 cubic feet—showing a saving of £1679, or £2 3s. per 1000 cubic feet.

In the case of the Hollinwood holder, a complete specification and drawings were got out for the two systems; and the average of eight tenders was as follows:

	Cost.	Per 1000 Cubic Feet.
For wrought-iron lattice standards of our own design, as per drawings.	£38,025	£7 2 0
For a spiral-guided holder	26,584	4 19 0
Showing a saving of	£11,441	£2 3 0

It is only fair to say that the strength and design of our steel standards and also the shell were on the strong side, but only such as I should like to have erected. The same may be said of the number and strength of the spiral rails, carriages, pins, base-plates, &c. They were not designed with any intention of showing the saving of spirals over the column-guided holder, as at that time it was not my intention to advise spiral-guiding for so large a holder.

In addition to the first cost, there will be a decided saving annually in painting the standards and girders. There was also a saving of £1000 in the construction of the concrete tank.

Stability of Spiral-Guided Holders.

I have not had a sufficiently long working experience with the spiral system to give particulars of difficulties likely to be encountered, as, so far, we have had none. But I should be pleased to have the opinions and experiences of others of our members who have had a longer acquaintance with holders guided on the system. I have, however, had some experience of strong gales, for during almost every gale for the past twenty months we have had the holders fully inflated, and have watched their behaviour. In every instance, they have appeared to be more steady than the column-guided holders adjoining, notwithstanding that the spiral-guided holders are double the height.

I must admit that on more than one occasion, when a strong gale has been blowing and I have been disturbed from peaceful slumbers in the small hours of the morning, I have been somewhat anxious as to whether something might happen, because of the holders being newly erected, and their various member being untried. On the night of the 18th of January this year, there was, I am informed by the night foremen on duty, one of the strongest gales and snowstorms they had experienced. The two holders at Higginshaw were each more than three lifts out of the water, and the one at the Central works was four lifts out. At 4 a.m., on looking through my bedroom window and seeing a heavy fall of snow, accompanied by strong drifting wind, I was curious to see the effect of snow on the crown and spiral rails of the Central holder, which is near to my house. I was somewhat disappointed, on my arrival, to find that the gale was so strong as to blow the snow over the crown and off the other side. What I desired, and expected to find, was several inches of snow on the leeward side of the crown, so that when the mills lit up I could put the holder on to the town and watch its behaviour. However, I was disappointed, and must now wait until another winter.

The Higginshaw holders are fairly well exposed, and stand on ground which is 650 feet above sea-level; so that the inner lifts are 755 feet above it, and we get very strong winds, though not so strong as I witnessed at Newcastle when on a visit of inspection to the 3½ million spiral holder there.

Advantages of Spiral-Guided Holders.

There are advantages and disadvantages in most things; and I suppose the same may be said of spiral-guided holders. The author has written this paper with a view to drawing the disadvantages from other gas engineers who have had longer experi-

ence in this system of guide-framing. I here give a few advantages of spiral-guided over column-guided holders.

1.—A saving of 30 to 40 per cent. in first cost of iron and steel work by dispensing with columns and girders.
2.—Saving in wear and tear and painting of steel standards and girders which require attention annually. This amount capitalized at thirty years can be put down at about 25 per cent. on the cost of the holder.
3.—Assuming that the steel standards and girders require renewing in (say) forty years at a cost of £10,000, this would be equivalent to £250 per annum, or £10,000 on the life of the holder.
4.—Saving in first cost of the concrete tank by dispensing with column foundations and tank guide-rails, £1000, or (say) 7 per cent. on the cost of the tank, and 4 per cent. on the cost of the holder.
5.—No risk of accidents to painters, &c., when scraping and painting standards and girders 180 feet high. All painting can be done from the ground level, all scamped work can be seen, no extra pay is required to climbers, and the difficulty of obtaining climbers for this class of work is dispensed with.
6.—Greater strength of the holder bell, due to the spiral plates and rails forming a bracing with the vertical stays inside the holder.
7.—When the holder bell is down, there is no obstruction of view by standards and girders.

The disadvantages of the system I shall be pleased to learn from those engineers who have had experience with spiral-guided holders.

Discussion.

The PRESIDENT (Mr. Samuel Glover) said Mr. Duxbury, in challenging them to discuss his paper, was, no doubt, like many others, seeking for truth and guidance from those who had had experience in the matters dealt with.

Mr. J. W. MORRISON (Sheffield), in opening the discussion, remarked at the outset that he was not "a spiral-guided man," and therefore could not contribute much to the subject, except, perhaps, as to the cost of the respective holders. Some time ago, when they at Sheffield decided to have an 8 million cubic feet gasholder constructed, he went very closely into the matter; and he found that by having a spiral-guided instead of a column-guided holder he would save about 20 per cent. on the structure. He did not care to take the risk, and did not think he had any cause to regret having decided upon the latter class of holder. From Mr. Duxbury's paper, he observed that the cost of the spiral-guided holder at Hollinwood worked out at £4 19s. per 1000 cubic feet, compared with £7 2s. for one constructed on the other system—thus showing a saving of £2 3s. per 1000 cubic feet capacity between the two. He (Mr. Morrison) thought the latter a very high figure, especially seeing that for his 8 million holder the cost was something like £3 2s. 6d. per 1000 cubic feet—less than half the amount put down by Mr. Duxbury.

The PRESIDENT: How many years is it since your 8 million holder was constructed?

Mr. MORRISON replied that it was about 1903. Proceeding, he said he would like to ask Mr. Duxbury what was the idea of using black composition on the plates of the holder. It seemed as if red lead had been used, and then the black composition. Usually, the painting was not done until the whele job was finished and the structure found to be tight. No doubt Mr. Duxbury had good reason for having used the composition as he had done, and members would, like himself, be pleased to have an explanation. He assumed the disaster at Ilkeston had directed a good deal of attention to the question of the construction of spiral-guided holders, and had probably caused the reading of the paper. In regard to this matter, it seemed to him that a heavy weight of snow on the crown of a fully inflated spiral-guided holder might cause jamming and a break.

Mr. J. C. BELTON (Chester) said, from some experience he had had with a spiral-guided holder at Chester, he was able to support a good deal of what had been said on the subject by Mr. Duxbury. The holder at Chester was not constructed under his own direction, but under that of the late Mr. Robert Hunter in 1893; and, with one small exception, they had had no trouble with it down to the present time. The slight difficulty referred to arose from the method of construction, which had since been abandoned in favour of that which Mr. Duxbury had adopted at Hollinwood In the early part of his paper the author mentioned Mr. Thomas Newbigging, and his remarks as to how, so long as the rollers were free to move within the guides, it was impossible for the holder to tilt so as to get out of the vertical, and his statement that the locking or gripping action gave rigidity to the vessel, enabling it to resist the overturning force—the rollers being free to rise and descend within the guides. At Chester, they had had some experience with regard to this. As those present would be aware, they had very strong north-west gales, and the gas-works were situated in a very exposed place—having to meet the full force of the gale coming up the valley of the Dee. In fact, if there was one spot more than another where a spiral-guided holder had to stand the full force of heavy gales, it was at the Chester Gas-Works. Well, he had always found that during the strong gales the oscillation was a great deal less with the spiral-guided holder than with the column-guided holder adjoining it. As to the remark made by Mr. Morrison about snow, they had never had any tilting of the spiral-guided holder consequent upon the accumulation of snow upon the side of the crown. The action of the holder in such circumstances would be much as was the case in a strong wind; and any tilting effect would be taken out by the rollers and guides.

Mr. J. H. BREARLEY (Longwood) remarked that some who were present were not in the happy position of having to deal with structures of such enormous dimensions and size as was the case with Mr. Duxbury, Mr. Morrison, and other engineers in charge of big works. At the same time, what these gentlemen had to say or write on subjects like the one now under discussion was always interesting and of value to the engineer in charge of smaller works. He thought Mr. Morrison had made a slight mistake, which should be corrected, with regard to the cost of the holders. In giving the average for the column-guided holder, Mr. Duxbury mentioned £7 2s. as the cost per 1000 cubic feet; whereas the spiral-guided holder worked out at £4 19s. He (Mr. Brearley) understood that the holder to which Mr. Morrison referred was a much larger one than that at Oldham—being of 8 million cubic feet capacity. Still, he (Mr. Brearley) was bound to acknowledge that £3 2s. 6d. was a remarkably low figure; and Mr. Morrison was to be congratulated upon his achievement. The speaker went on to say he was a thoroughgoing supporter of spiral-guided holders, at all events for small gas-works. In his own case, there had not been a single mishap, and no cause for anxiety at any time. Eleven years ago, they replaced a column-guided holder by a spiral-guided one, and certainly they had had no cause to regret it. Not the slightest oscillation was shown on their charts from this holder; whereas they always had violent variations from the column-guided holder in the case of heavy gales. Mr. Brearley offered to furnish to those members who required them details of how he stopped one of the tanks at the Longwood works from leaking. He explained that it was a tank constructed some twenty or twenty-five years ago, and it leaked to the extent of 3 inches a day. By the use of various fibrous substances, they gradually reduced and eventually stopped the leakage. There was not time to go into the details; but he would be pleased to supply any member with them privately.

Mr. BROWN (Birkenhead) drew the attention of Mr. Duxbury to the fact that the grooves in the wheels appeared to be somewhat shallow, and also to the difficulty of lubrication arising from the construction and fixing of them. He suggested that it would be better to have the grooves a little deeper and the flanges somewhat wider.

Mr. J. P. LEATHER (Burnley) considered that an improvement might be made in the construction of spiral-guided gasholders by having tangential as well as radial rollers, seeing that it was not vertical but side pressure which had to be met in gales. He confessed that he had not been convinced as to the seven advantages which Mr. Duxbury claimed for the spiral as against the column-guided holder. Still, when called upon to undertake the erection of a new holder, he would certainly give careful consideration to both systems.

Mr. E. A. HARMAN (Huddersfield) humorously observed that in the discussion one point had not been dealt with, and that was the extreme ugliness of spiral-guided holders. It seemed to him that, after all, some attention ought to be given to the question of the appearance of gasholders. He asked those present to compare the two systems by the maps before them, which had been used by Mr. Duxbury to illustrate the points in his paper. One was "a thing of beauty;" and the other—well, he would not say what it was. [Laughter.] Beauty, he submitted, should not be ignored altogether, though the cost might be less in the one case. Why should their gas-works be made ugly in appearance? They ought to make them as beautiful as possible. [Renewed laughter.]

Mr. S. SHADBOLT (Fleetwood) sympathized with the remark of Mr. Duxbury that on more than one occasion, when a strong wind was blowing, he had been disturbed at night by anxiety as to the safety of his spiral-guided holders. He (Mr. Shadbolt) had had experience of this himself when engaged on works in another part of the country where there was a spiral-guided holder in a very exposed position. Awakened in the night by the violence of a gale of wind, and feeling anxious about the holder, he said: "If the holder is standing in the morning, I shall never fear as to spirals again." And the holder was intact in the morning. On the subject of the tanks, he thought that with those which were above ground there was a risk through frost. There was not so much danger, in his opinion, from the accumulation of snow on the crown; but with regard to tanks standing out of the ground, there was danger from frost. On the general question, it seemed to him that it was not so much the scientific convictions that had to be driven home but the driving-out of a rooted prejudice against spiral-guided holders.

Mr. J. W. BROADHEAD (Messrs. Robert Dempster and Sons, the Contractors for the new holder) continued the discussion. He remarked that he had been interested in spiral-guided holders ever since they were invented. From many calculations made, investigations carried out, and the result of much experience, he was convinced that the spiral holder was not only quite safe when properly constructed, but safer than the ordinary column-guided one. Incidentally, he said he did not think the introduction of tangential rollers, as suggested by Mr. Leather, was necessary.

Mr. DUXBURY, replying upon the discussion, said the subject before the members was one which, in his opinion, was not discussed quite so much as it ought to be; and he confessed that, in deciding to read a paper upon it, he hoped to be able to get a few

"wrinkles" from those who had had experience with spiral holders. Several points had been brought out which would lead the members to think. With regard to Mr. Morrison's remarks as to cost, he was aware that it was very low for the 8 million feet holder at Sheffield; and he did not quite know how that gentleman managed it. Whether he chose a time when the market value of material was low, or was favoured by some other circumstances, he (Mr. Duxbury) did not know. At any rate, Sheffield had its holder at a remarkably low figure. On this point, he desired to explain that in the case of Oldham they went in for a much stronger and heavier structure than they needed; but, as was stated in the paper, they preferred to err on the strong side. With less weight, the cost would, of course, be less. Further, Mr. Duxbury said that in the figures quoted by him, he took the average of eight tenders. He did not care to publish the actual figures of the contractors—that would scarcely be fair. Therefore it would be gathered that the cost in their case would be less than that quoted in the paper. The black composition was used because the plates, having lain out in the winter months (four), were getting rusty and dirty. In answer to a question about the cost of the tank, Mr. Duxbury said that it would work out at £2 8s. 6d. per 1000 cubic feet; and, as he had said, the actual cost of the holder would be less per 1000 cubic feet capacity than the £4 19s. given in the paper. With reference to the point about the grooves in the wheels being rather shallow, he thought they were quite sufficient for their purpose; and it was not necessary to have them of greater depth. As to Mr. Harman's observations, there was this to be said about the spiral-guided holder—when it was down in the water there were no ugly columns to be seen, as was the case with the other system. With regard to the question of lubrication, which had been mentioned, he did not anticipate having any difficulty.

COAL GAS REGARDED AS THE MOST CONTROLLABLE SOURCE OF HEAT.

In a recent number of the "Journal für Gasbeleuchtung" appeared an article by Dr. FINK, of Berlin, entitled "Coal Gas the Most Controllable Source of Heat," of which we give a short summary.

In practice, it is of the greatest importance to choose those sources of heat which are cheapest and, at the same time, most easily regulated in use. Coal and electricity, as sources of heat, have this in common, that they can only be regulated to a limited extent. If an apparatus of any kind is heated by electricity, all that can be done is to cut off the current partially or totally. The temperature in a kettle which is heated over a coal-fire can only be influenced by increasing or decreasing the current of air to the fire, or by removing the glowing coal itself. The same difficulties are experienced with liquid fuels, such as benzol, petroleum, and methylated spirit, with the extra trouble added of unburnt carbon, which shows itself in the form of soot, and is one of the worst conductors of heat imaginable.

With coal gas all this is totally changed. The cost of its production is constantly becoming smaller, and to-day 19,000 B.Th.U. can be had for 1d. But quite apart from its inexpensiveness, there is in coal gas a source of heat which almost reaches perfection in the ease with which it can be regulated, and which gives the nearest approach to that great ideal "waste no energy."

In using up available heat, the conducting capacity of the bodies in question plays a large part. This capacity, of course, varies considerably, as shown by the following table:—

Air	0·0034	Lead	5
Water	0·07	Iron	10
Glass	0·1	Copper	60

From this it is seen that air is an extremely bad conductor of heat. Hence the object of a baking oven is best obtained by arranging the gas-flames in various horizontal or vertical planes; otherwise an even temperature is impossible. Water is likewise a bad conductor; and it would be quite wrong to bring the gas-flames to bear on the sides only of a kettle. The bottom must, of course, be heated directly by the flame, and the sides are prevented by the waste gases from cooling. Glass and lead are better conductors; but the former is so liable to crack when heated. Iron is better still; and copper best of all.

With the use of a copper soldering iron care must be exercised to prevent waste of gas. It must be made hot enough to melt the soldering tin—that is to say, 450° Fahr. But it must also have sufficient extra heat to be able to impart some of it to the surfaces which are to be soldered. If, however, the soldering iron is made red-hot (as is often the case), it can take up no tin, and so has first to be cooled in water. This implies loss of energy and waste of gas.

Another example of frequent waste is to be found in the way in which the crucibles of type-founding plants are generally heated. These can be worked at temperatures varying from 550° to 750° Fahr., according to the make. But in testing the temperatures in practice, the author generally discovered the type-founders working with 100° to 200° Fahr. too much, and quite convinced that they were wasting no heat. He thought it expedient to remedy this evil by the adoption of an automatic temperature regulator, the "Fink-Auté," shown in fig. 1. In Berlin to-day, there is hardly a monotype setting machine which is not fitted with this regulator.

It is ridiculous to judge the efficiency of gas as a source of heat by the size of the visible flame, as the uninitiated are prone to do. By forcing compressed coal gas and compressed air through porous bodies, and allowing them to burn inside, Professor W. A. Bone has succeeded in obtaining a temperature of 3630° Fahr., without the flame being so much as visible. The greatest heat developed from coal gas is in the invisible flames; next come the violet and those which are green in the middle; and lowest of all the yellow.

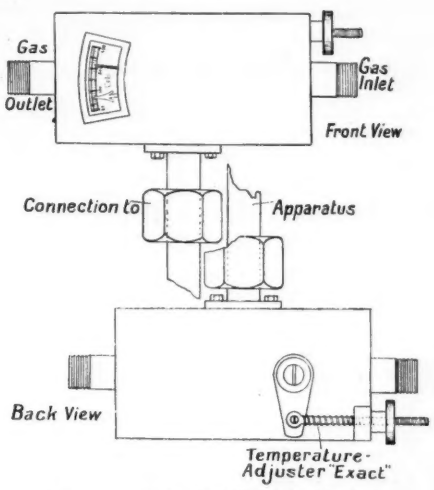


Fig. 1.—Fink's "Auté" Water-Heater.

An example of the use of low gas temperatures is the heating of acid baths for gilding or silvering metals by electrolysis. Though these baths are used at a temperature of only 150° to 170° Fahr., yet it is all important that this should be kept constant. Hence for heating them, coal gas is used for preference.

In the kitchen, too, only low temperatures are required; for, of course, water boils at 212° Fahr. But an ordinary open gas-cooker only uses up about 25 per cent. of the available heat; whereas, by judicious choice of apparatus, 90 per cent. can be used, While on this subject, the new "paper-bag cookery" system. which appeals to so many, may well be mentioned. The food to be cooked is first enclosed in an air-tight bag, which is so constructed that it cannot burn even in the greatest heat. It is then put in the gas-oven and needs no further attention. The important point is to keep the temperature constant, and this is most easily effected with gas.

The automatic temperature regulator "Fink-Auté" can be applied with good effect to Weber's warm water apparatus (fig. 2),

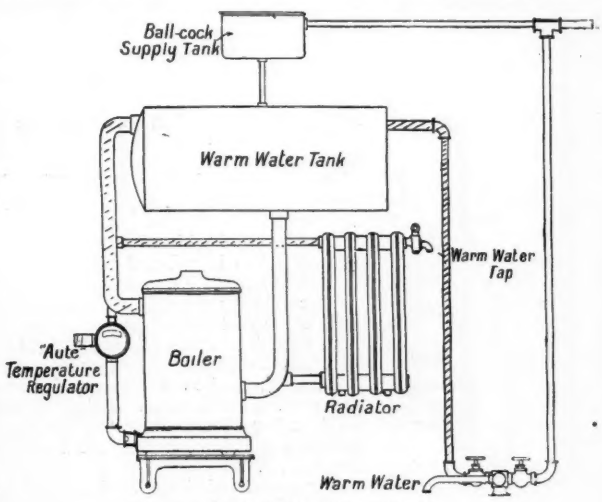


Fig. 2.—The "Rapid" Water-Heater.

which has the great advantage of conveying heat simultaneously to the water in the tank and that in the circulating pipes, so that it runs warm at once.

Before attempting to use a largely increased quantity of gas anywhere, it is of great importance to see that the pipes are ample in their dimensions. If they are too small, the gas pressure is diminished, too little air is taken up, and the gas is only partially burnt-up—the flames becoming sooty. The author recommends, as a sound working standard, not to allow the gas pressure to go below 10-10ths at the actual spot where the heat is to be applied.

A considerable increase of temperature can be obtained merely by adding to an ordinary bunsen burner mountings which, by

prolonging the burner tube, and covering it with mesh-work of wire of convenient shape, cause more air to be drawn in and to be better mixed with the gas. These give the best results with six volumes of air to one of gas, whereas the old bunsen burners could only take three of air to one of gas. The form of the flame which these burners give is, however, not always suitable for the work in hand. If a pointed flame is required, and at the same time an extra high temperature, the best results are obtained by the use of oxygen. The author has produced some interesting flame formations with the "P.O." burner, shown in fig. 3. The

Fig. 3.—The "P.O." Burner for Coal Gas and Oxygen.

coal gas can be used at high or low pressure. With the former, however, considerably less oxygen is required than with the latter. For this apparatus, the oxygen is best used in cylinders, fitted with a good regulating valve, having a gauge which shows both the contents and the pressure in the cylinder. Each burner should be marked with the pressure at which it works, to which the gauge has to be set. With this mixture of coal gas and oxygen a temperature of about 2910° Fahr. is obtainable.

Besides this patent of the author, there are two other methods of obtaining highly efficient flames. One of these brings compressed air into the burner. The other compresses the gas, and the force of the stream of this compressed gas through the tube automatically causes air to be drawn through the holes of the burner; and, naturally, the greater the gas-pressure, the more air is drawn in. For this compressed gas system, the author has constructed an apparatus with a special regulator [shown in fig. 2 in the "JOURNAL," Vol. CXIII., p. 41.] This apparatus is very simple in construction, and can be fitted up very cheaply; yet a gas pressure of 800-10ths is obtainable with it.

Now comes the question, when is high-pressure gas preferable to that of ordinary pressure as supplied from the gas-works?

1. In all cases where the pipes are somewhat limited in their dimensions, and the consequent loss of pressure by friction is so great as to prevent the required quantity of gas being available. This is frequently the case with factories which have made later additions on a large scale to their works.

2. With gas-flames which burn in enclosed spaces—such, for instance, as internal combustion irons. In such cases, with ordinary gas-pressure insufficient air is taken up, and to produce a really good blue flame artificial pressure is necessary.

3. For soldering of all kinds compressed gas is preferable. The author has devised a soldering iron which is very convenient when a connection of rubber tubing is practicable. A 2 lb. copper iron of this kind consumes 3·5 to 5·5 cubic feet per hour. If for any reason the rubber connection cannot be used, the irons must be heated on a stove. The one shown in fig. 4 uses 10·5 cubic feet

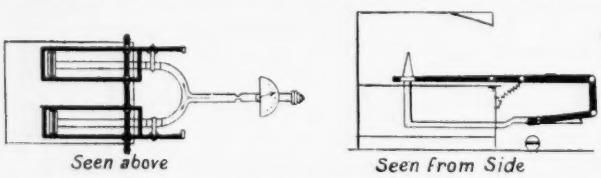


Fig. 4.—Soldering Stove for High-Pressure Gas, with Automatic Flame Regulator.

of gas per hour for heating two irons of 2 lbs. each. The old soldering stoves with low-pressure gas and compressed air used twice this amount of gas.

High-pressure gas can also be used with advantage in type-founding machines. The author has introduced improvements into the existing systems—such as those of Foucher, Küstermann, Böttcher, and Gursch. A crucible for the lead with a pouring spout at the side is generally used; and the gas-flames under the crucible must be turned high enough to warm this spout right to the top. The author achieves this object, however, by means of a special curved row of burners; and in the case of some machines, as much as 40 per cent. of gas is saved. But great care must always be exercised in using high-pressure gas for type-founding machines, for the bottoms of the crucibles are liable to become porous when heated with it.

A very good opportunity for the extended application of high-pressure gas is in the heating of workshop furnaces, for which hitherto only compressed air has been used. But numerous experiments have still to be made before good results are obtained. The author recommends that special attention should be devoted to the waste gases. In all cases where he has applied a thermometer to them, the story it has told has been far from satisfactory.

In conclusion, the author draws attention to the latest discovery of Dr. Werner Boltoni, of the firm of Siemens and Halske, who, by the action of coal gas on certain amalgams of quicksilver with other metals, has succeeded in separating out carbon in its crystal form—that is to say, as diamonds. However small these may actually be, the experiment points to great possibilities for coal gas well worth bearing in mind by men of all kinds connected with the gas profession.

ILLUMINATING ENGINEERING SOCIETY.

The Annual General Meeting of the Society was held last Tuesday, at the Royal Society of Arts. Mr. HAYDN T. HARRISON was in the chair, owing to the unavoidable absence of the Chairman of the Council (Mr. F. W. Goodenough).

NEW MEMBERS OF COUNCIL.

The CHAIRMAN announced that one-third of the Council retired at the end of the year; but those retiring by rotation had expressed their willingness to be re-elected. Four members had expressed a desire to resign; and no new nominations having been received, the Council had elected the following gentlemen: Dr. H. R. B. Hickman, Dr. R. Lessing, Mr. W. R. Rawlings, and Dr. A. H. Levy.

The HON. SECRETARY (Mr. Leon Gaster) read the main parts of the annual report of the Council.

Progress and Membership.—In the course of the report, the Council express satisfaction with the progress during the session. During the year, the Society has been fortunate in extending its influence in many directions. Meetings have been devoted mainly to securing the co-operation of the general public, and many subjects of great interest have been discussed. A marked feature of the session has also been the consolidation of the international position of the Society, which is now coming to be regarded as the European centre of information on matters connected with illumination. The development of public interest in illumination and the increased output of literature on the subject has again been most remarkable. It is particularly satisfactory to observe the direct interest taken by the daily Press in the practical consequences of insufficient illumination. This has taken the form of frequent references to such matters as street lighting, the influence of illumination in mines on the eyesight of miners, the lighting of the House of Commons, &c.

There is a steady growth in membership. The number of members now exceeds 350—an increase of eighty over the number at the corresponding period of last year—and the support of eminent authorities in various parts of the world, many of whom have taken a prominent part in other national and international commissions dealing with photometry and illumination, has been obtained. The following figures serve to show the exceptional position enjoyed by the Society in providing an impartial platform for the discussion of problems connected with illumination:

	Per Cent.
Electrical engineers and members concerned mainly with electric lighting	32
Gas engineers, manufacturers of gas appliances, &c.	20
Professors of physics and engineering, experts in photometry	14
Representatives of oil, acetylene, petrol air gas lighting, &c.	6
Physicians, oculists, opticians, &c.	10
Architects, surveyors, &c.	5
Miscellaneous, including public lighting superintendents, mechanical engineers, makers of shades and reflectors, and others not exclusively connected with any one system of lighting	13

Then follows a review of the meetings held during the year.

Special Committees on Street, School, and Library Lighting.—The Joint Committee—on which representatives of the Institutions of Gas and Electrical Engineers, the Association of County and Municipal Engineers, and the Illuminating Engineering Society are nominated—is still engaged on its task of preparing a draft specification for street lighting. A considerable number of meetings have been held, and much valuable data collected; and it is anticipated that its findings will be available shortly. The Joint Committees on School and Library Lighting decided upon at the conclusion of the discussions of the Society on these subjects at the commencement of last year have now been constituted. Representatives of the Library Association, the Association of Medical Officers in Schools, the Association of Technical Institutions, the Association of Teachers in Technical Institutions, and the London Teachers' Association have been appointed, and are taking part in the proceedings. Several meetings have already been held; and the Committees are preparing some suggestions which, it is hoped, will prove of considerable use to those concerned with the lighting of schools and libraries. In addition, it is proposed that these Committees will act as a permanent centre for information on these subjects.

International Commission on Illumination.—One of the most important events during the past year was the decision taken at the International Electrical Congress in Turin last September. It will be recalled that the Congress unanimously passed the following resolution at the plenary meeting on Sept. 16, 1911: "That this Congress deems it desirable that an International Commission should be appointed in order to study all systems of lighting and technical problems in connection therewith; and, having been informed that the Illuminating Engineering Society of London has the intention of forming such a Commission and of putting itself in touch with the other existing national and international photometric committees, approves their taking the initiative in this respect." A resolution was also passed unanimously by the Electrotechnical Commission affirming that the National Committees should co-operate with the Illuminating Engineering Societies in their respective countries in studying the question of symbols, nomenclature, and other matters relating to illumination.

The Hon. Secretary—who was present at these meetings in Turin—also read a paper on "The International Outlook in Scientific Illumination," in which he demonstrated the value of such an International Commission on Illumination. It was pointed out that, although valuable pioneering work had been carried out by the existing national and international committees concerned with illumination and photometry, these committees lacked the necessary impartial and international standing for their decisions to be received with the necessary authority in different countries and by representatives of different illuminants. Moreover, what was desired was a Commission which, besides dealing

with purely photometric matters, would have power to deal with certain questions of great practical importance (such as the hygienic aspects of illumination, the framing of standards regarding the illumination required for various purposes, &c.).

In receiving the sanction of the International Electrical Congress to form such a Commission, the Society has been afforded a most gratifying recognition of the impartial and international position. It will naturally be desirable to arrange for due representation on the suggested Commission of existing bodies dealing with various aspects of illumination. In this respect the Society is in an exceptionally fortunate position, since it now includes among its members delegates on all the chief commissions of this kind. For example, during the vacation a number of delegates to the International Photometric Commission and the International Electrotechnical Commission gave their support by becoming corresponding members. It need scarcely be added that in this work the co-operation of the American Illuminating Engineering Society, many of whose members are also supporters of our Society, will be very valuable.

By this resolution, it will be observed, the support from the electrical industry throughout the world has been secured, and it is hoped to obtain similar international encouragement from the gas industry.

Hygienic Aspects of Illumination and the Prevention of Industrial Accidents.—As an additional example of the activity of the Society during the last summer vacation, it may be mentioned that the International Hygienic Exhibition at Dresden was visited by Mr. Justus Eck and Dr. R. Lessing, and the Society was also represented locally by Drs. Schanz and Stockhausen and by Professor Ulbricht. A series of exhibits dealing with illumination were also dispatched to the Exhibition, including various photographs, taken by artificial light and showing the illumination of schools and factories by gas and electricity, which were much appreciated.

The question of the hygienic aspects of lighting in factories continues to receive attention in this country. It is understood that the Home Office are making arrangements for tests of the illumination in various factories, to be made with a view to establishing ultimately some form of standard. It will be recalled that the report issued by the Departmental Committee on Accidents in Factories contained specific reference to illumination; it being pointed out that "inadequate lighting is a very frequent cause of accident and of grave danger." It is also recommended that "inspectors should be given general statutory power to require adequate lighting in all places where work is done and in all places which are a source of danger by reason of insufficient lighting." It will also be remembered that in the last report of the Council stress was laid on the important position assigned to illumination in the deliberations of the second Congrès International des Maladies Professionelles in Brussels last year. Special reference was then made to the need for effective lighting of dangerous machinery.

The precedent set on this occasion has now been followed by the announcement of a Congress on the Prevention of Industrial Accidents, to be held in Milan at the end of May. The Society will be represented by the Hon. Secretary (Mr. L. Gaster), who has been invited to read a paper on "The Value of Good Illumination from the Hygienic Standpoint and as a Means of Preventing Accidents." It is hoped that this congress will be the means of still further interesting insurance and other authorities, and also the representatives of the Governments of various countries in these matters.

An exceedingly important step has also been taken by the French Government in appointing a Committee on the Hygienic Aspects of Illumination. On this Committee prominent oculists and physiologists, engineers, and factory inspectors, will serve; and it will discuss many matters of considerable industrial importance (such as the framing of standards of illumination, and of simple lighting rules for use in factories and workshops, the nature of defects of vision and their relation to unsatisfactory lighting conditions, methods of measuring illumination, &c.). The Hon. Secretary, in the course of his visit to the Continent, took the opportunity of interviewing some of the experts on this Committee and the representatives of various Government departments interested in the subject; and it is hoped that the action taken by France will shortly be followed in other countries. The experience of authorities in different countries is needed in these matters, in order that general recommendations which will be acceptable throughout the world may ultimately be made, and also with a view to avoiding any errors which might naturally arise in physiological investigations conducted only on a few individuals.

It may also be mentioned that the conditions of illumination in factories and workshops have been the subject of much consideration in the United States.

Education in Illuminating Engineering.—In the last report of the Council attention was called to the special post-graduate course of thirty-six lectures organized by the Johns Hopkins University of Baltimore, U.S.A., in the autumn of 1910. Various branches of illuminating engineering were dealt with; the lectures in each case being delivered by eminent authorities in their respective subjects. In referring to this unique series of lectures, the hope was expressed that courses in illuminating engineering would shortly be arranged in this country. This anticipation has been realized. During the last winter four distinct courses of lectures were delivered at University College, Regent Street Polytechnic, the Northampton Institute, and Battersea Polytechnic. The course at University College, by Professor W. C. Clinton, was of an advanced character. The other three courses were more general and popular in their scope, and were delivered by specialists in their respective fields. It may be added that, almost without exception, the lecturers were members of this Society. It is estimated that over 100 students attended these courses. This may be considered a most gratifying beginning; and it is hoped that ultimately courses in illuminating engineering will form a regular feature of the programmes of the chief colleges and institutions.

The Title of "Illuminating Engineer."—The three years that have elapsed since the formation of the Society have given a great impetus to the illuminating engineering movement, and have stimulated a demand for expert advice on illumination. From the commencement, it has, however, been agreed that the use of the title "illuminating engineer" by consulting experts on lighting should be deprecated, and membership in the Society is not at present regarded as entitling members so to describe themselves. Until a body of men who have the necessary qualifications and experience to deal impartially with all illuminants and with the various aspects of lighting included under the term "illuminating engineering" has been evolved, the use of the term "illuminating engineer" should be avoided. At a later date, it is hoped that it will be possible to define more precisely what the qualifications of an illuminating engineer should be; and this matter will then receive the attention of the Society.

Mr. V. H. Mackinney, in moving the adoption of the report and balance-sheet, pointed out as an important feature of the former the explanation as to the international situation. Too much stress could not be laid upon this particular section of the work. The fact that they had assistance by personal representation abroad—sometimes at meetings, and continually by correspondence—showed that this was a world-wide organization with world-wide interests.

Mr. W. J. Liberty seconded the motion. He thought they might congratulate themselves upon the position of the Society and upon the broadness of their platform. They might also congratulate themselves upon the quality as well as the quantity of the papers that had been read during the session.

The motion was unanimously carried.

The President.

Certain modifications in the articles of association having been agreed to, on the motion of Mr. W. R. Rawlings, seconded by Mr. J. G. Clark,

The Chairman said he had an important statement to make; and it was partially due to this that one of the articles had been modified. The Council—in their cordial appreciation of their President's (Dr. Sylvanus P. Thompson's) great services to the Society during the past three sessions, and in view of the important work this year in connection with the International Commission on Illumination, and in view of the fact that the Society had an able Chairman—had resolved to intimate to the President that it was their desire that the Society should continue to profit by his services, and keep him in office. As the members knew, Professor Thompson had been a most valuable help to the Society ever since he became their first President. In the coming year particularly, they wanted him to serve again, because of the International Convention at which the Society were to be represented; and Professor Thompson, with his wonderful knowledge of everything connected with their particular work, would not only represent them better than they could be represented by anyone else, but he would confer a glamour on their Society among the societies of the world. Therefore the Council were anxious to ask him to act again as their President; and in order to do this, it was necessary to re-elect him again as their President, if he would kindly serve. They were asking a great deal of him; and if he would only serve again, the Society would be represented by one of the most important and honoured scientists of the day. Under the circumstances, the members would agree with him in hoping that Professor Thompson would accept the presidency for the fourth time. [Applause.]

New Vice-President.

The Chairman next announced that Mr. A. P. Trotter had been nominated as one of the Vice-Presidents. He was known to all of them; and therefore there was no need for him to give any account of the work he had done not only for the Society, but for illuminating engineering generally.

Votes of Thanks.

Moved by Mr. Liberty, and seconded by Mr. Clark, a hearty vote of thanks was passed to the Council and officers for their efforts on behalf of the Society during the past year. Special mention was made of Professor Thompson, Mr. Goodenough, Mr. Haydn Harrison, Mr. Gaster, and Mr. Dow.

Among other votes of thanks was one, which was heartily passed, to the Council of the Royal Society of Arts for the use of the lecture theatre and rooms.

International Co-operation.

Mr. Gaster announced that he was about to visit America, in response to the invitation of the American Illuminating Engineering Society for closer co-operation in their work. He would like to see whether they could not co-operate with their friends in America, and make London a centre between the States and the Continent.

Mr. Rawlings intimated that neither Mr. Gaster nor Mr. Dow was remunerated for the enormous amount of work they both did for the Society; and Mr. Gaster was going to America at his own expense. He proposed a vote of thanks to Mr. Harrison for presiding.

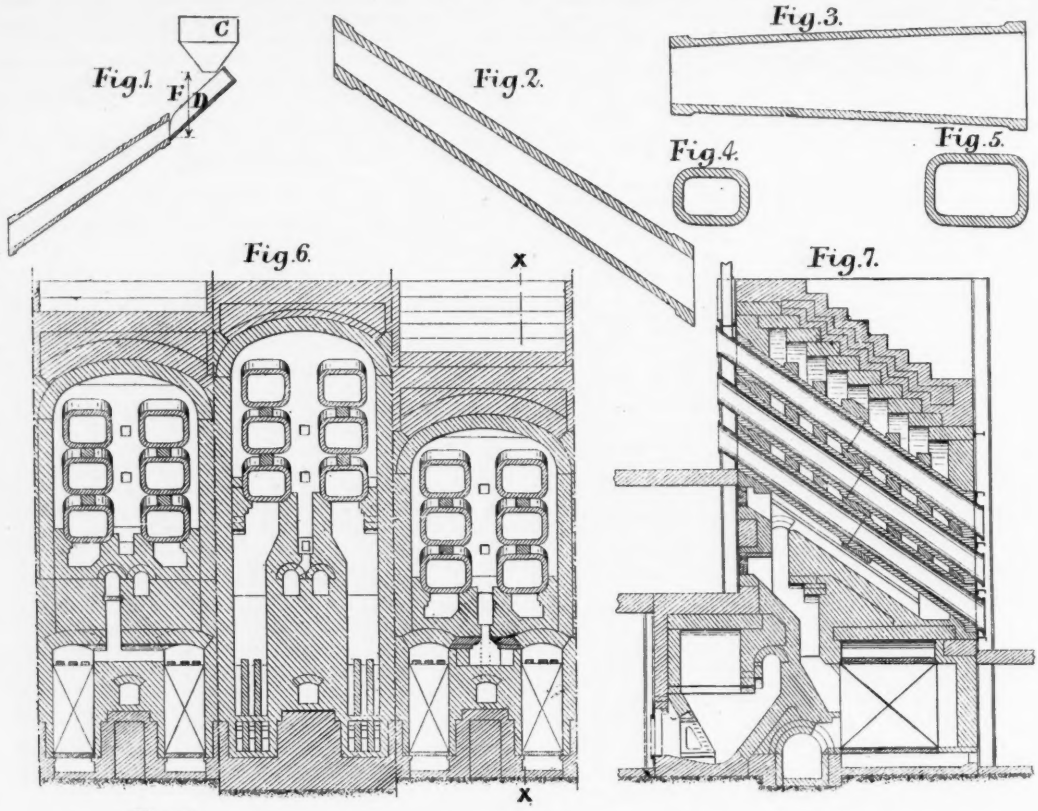
This was unanimously passed, and the proceedings thereupon terminated.

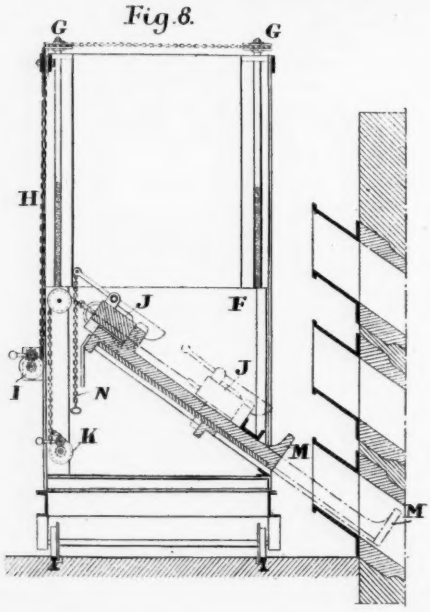
The Vertical Gas-Retort Syndicate, Limited, report that they have received advice from the Dessau Company to the effect that the following further orders have been received for Dessau verticals: At Turin, six beds of ten retorts; at Mainz, six beds of eighteen retorts; at Cassel, five beds of eighteen retorts. All these will be 4-metre long retorts; and the additions in all total to 258 retorts.

CARBONIZING COAL IN LARGE QUANTITIES.

There has lately been published the specification of a patent taken out for France by M. Breuillé for an improved process for the carbonization of coal in large quantities. The plant is shown in the accompanying illustrations, and the descriptive particulars are translated from the specification.

The patentee says that hitherto the distillation of large quantities of coal for the production of lighting and heating gas has been limited to vertical or horizontal retorts; but the process which is the object of his invention is based upon the employment of inclined retorts. Those in use up to the present time have been constructed to receive a charge of coal from 4 to 4¾ inches thick, evenly distributed over the floor of the retort, as in the case of those set horizontally. It was therefore necessary for them to be placed at an angle of 33°; otherwise the coal was not spread in a uniform layer, and carbonization was variable. The process devised by M. Breuillé is to distil large masses—*i.e.*, in full charges. The floor of the retort is at an angle of 35° to 40°; and the retort itself is in shape a slightly truncated cone lengthwise—*i.e.*, the mouth is narrower than the discharge opening—and the sides are flat. The conical shape of the retort causes the mass of coke to fall out freely when it has been set in motion either by hand or by a suitable machine such as that to be described later on.





Regular and complete charging of the retorts is effected by means of a shoot, the bottom of which may be inclined.

In the accompanying illustrations, fig. 1 shows the charging device; fig. 2 is a longitudinal section of the retort; fig. 3 is a plan of it, and figs. 4 and 5 are sections of the ends. Fig. 6 shows vertical and longitudinal sections of the settings; fig. 7 is a transverse section on the line X of fig. 6; and fig. 8 is a side elevation of the machine for pushing the coke out of the retorts.

The inclined retort is enclosed in a setting, and heated to a high temperature by a furnace or producer in the ordinary way. Figs. 6 and 7 show the grouping of a certain number of retorts in settings of the usual form, where they are heated by a producer. They may all be arranged in one group the entire width of the setting, or, as in the present case, in two groups in juxtaposition. The retort is charged by conveying the coal from the hopper C through the shoot D into the mouth. Regular and complete filling of the tiers of retorts is a function of the angle of inclination of the shoot, the height from which the coal falls in it, and the distance from which it drops into the retort. The maximum charge can be obtained either by increasing the angle and decreasing the height, or, inversely, by increasing the height and decreasing the angle. The charge can be altered during working, thanks to variation of the angle of the shoot, so as to obtain a better distribution of the coal dust and lumps which may collect near the higher part of the retort. The mass of coke will fall out freely as soon as it is moved a little near the discharging end, because, owing to the shape of the retort, space is left between the coke and the sides, thus avoiding friction on three surfaces. To cause this initial movement in the coke, it can be pushed by hand or by a device similar to that shown in fig. 8.

The pushing machine consists of an inclined support carried by a frame F mounted on wheels running along rails opposite the charging ends of the retorts. The support can be brought to the level of the different retorts by means of parallel wormed rods simultaneously set in motion by wheels G, actuated by the chain H and a train of toothed gear I. A weight J, which rolls along the support, can be drawn to the top by means of the winch K, and then suddenly released by unfastening the winch catch. The weight then descends, and strikes the buffer of the pusher M, which enters the retort, and comes into contact with the coke. The pusher slides smoothly on the support, and, acted upon by the weight J, drives forward the mass of coke, which, once set in motion, falls out without further attention. The pusher is arrested by a stud. By means of the winch K, the weight J is raised to the top of its support. The machine just described is the one devised by the inventor for removing the coke from the retort; but any other can be employed.

The advantages claimed for M. Breuillé's system of carbonization are: (1) The greater inclination of the retorts makes it possible to fill them almost completely (instead of having a comparatively thin layer of coal), and consequently to carbonize large masses. (2) The charging and drawing are effected simply by

gravitation; thus economizing labour, and dispensing with the charging and drawing machines employed for horizontal retorts. (3) The possibility of injecting steam with good effect through the lower opening of the retorts; the steam passing through the mass of coal in process of carbonization to increase the production of gas and almost double the amount of ammonia. The patentee submits that this is impossible with inclined or vertical retorts in which space is left above the coal. (4) Reduction of pressure of the gas in the base of the retort, even when fully charged; the coal near the roof being larger and less compressed than that near the floor; and the lumps allowing a free liberation of the gas.

COMMERCIAL AND FINANCIAL ASPECTS OF THE GAS INDUSTRY.

One of the items in the programme of proceedings at the celebration of the centenary of the use of gas as an illuminant, held at the Franklin Institute, Philadelphia (Pa.), last month, and to which reference has already been made in the "JOURNAL," was an address by Mr. GEORGE B. CORTELYOU on the subject of the "Commercial and Financial Aspects of the Gas Industry." The following are the principal portions of the address.

After briefly expressing his appreciation of the initiative and energy which had made possible the proceedings at the celebration, and his pleasure at participating in them, Mr. Cortelyou gave a sketch of

THE EARLY HISTORY OF GAS LIGHTING.

Commencing with the work of Murdoch, Lebon, and Winsor, all of which is well known to people engaged in the gas industry, he came to the projection by Winsor of the National Light and Heat Company, and his unsuccessful application to Parliament in 1809 for an Act to incorporate it. In 1810, however, he obtained his Act, and the formation of the Gaslight and Coke Company was the result. The incorporation of this Company, in April, 1812, was an important step in the direction of placing the new industry on a basis which promised its permanent establishment, and increased the probability of its ultimate success. In 1813, Westminster Bridge was lighted by gas. As the Engineer of the Company, Samuel Clegg was engaged, who was not only the inventer of the gas-meter, but the pioneer in many of the important inventions connected with gas lighting. Besides the gas-meter, he introduced the cylindrical gasholder and an automatic pressure-regulating device. He was chiefly responsible for the success of the Company, and was the first to commercialize city gas lighting on a large scale. By 1816, gas had become very common in the City of London; and Paris was first lighted by it four years later. In 1833, the French National Gas Company was projected for lighting Boulogne-sur-Mer. Gas was used at Havre, Caen, and Amiens in 1835, and at Nantes and Rouen in 1846.

Before the second gas company was authorized for London, the City of Baltimore granted a Charter to the first company to be regularly organized for the purpose of exploiting gas for the illumination of streets and cities in America. Baltimore was not only the first city to be lighted with gas, but it was also the first in which gas-meters were manufactured in the United States; and the name of Samuel Hill is given as the maker.

According to a brief historical summary of gas development in the United States given in the census reports for 1910, the history of the gas industry in America dates from 1806, at which time David Melville, of Newport (R.I.), lighted his premises by means of coal gas which he had manufactured thereon. This took place nine years after the experiments in England. The apparatus used was necessarily crude; but it underwent improvements from time to time until, in 1813, Melville secured a patent, and later used gas for the lighting of a cotton mill in Watertown (Mass.). Gas was also used at about this time in a mill near Providence (R.I.), and was employed in 1817 as an illuminant in a lighthouse. The growth of the industry was at first slow; but with the advances in the details of the construction and operation of gas plants, the improvement and development of special tools and appliances, and the increasing knowledge gained by experience of the laws of physics involved, there came a much more rapid growth. As early as 1816, a company was chartered in Baltimore, followed in 1821 by the formation of a Company in Boston (Mass.). New York City adopted gas lighting in 1823; and several years later, companies were formed in Brooklyn (N.Y.) and Bristol (R.I.). New Orleans adopted gas about 1835—twenty-nine years after Melville introduced the new illuminant in America. A proposition to light Philadelphia with gas was made in 1803, and a similar one in 1817; but both offers were rejected. Repeated efforts were subsequently made in the direction of lighting the city with gas; but it was not until March 21, 1835, that an ordinance was passed providing for the construction of the works. The plant was completed on Feb. 8, 1836.

Mr. Cortelyou next referred as follows to the

OBJECTIONS TO THE INTRODUCTION OF GAS.

Like most inventions, gas lighting was not at first taken seriously. It seemed to the American and European world of 1800 to be on a par with the Laputan philosopher's scheme for making sunshine out of cucumbers. People were afraid of this "burning air," as it was called, and could not be convinced that fire or explosion would not be the inevitable result of its general use. When that daring New Yorker, Samuel Leggett, first lighted his house, No. 7, Cherry Street, with gas, people stood at a respectful distance. In Europe, the prejudice against gas lighting at the time of its introduction was equally strong. Napoleon ridiculed it, and said: "*C'est une grande folie.*" In 1803, Sir Walter Scott wrote to a friend: "There is a madman proposing to light London with—what do you think? Why, with smoke!" Yet Scott himself had Abbotsford piped for gas not many years later. Clegg gives an account of the horrors of the lamp-lighters when they first beheld the burning gas, and how he was obliged to light the lamps himself for some time, on account of the fears of the people. Even such men as Sir Humphry Davy and Sir Joseph Banks were unable for many years after this to overcome the prejudice which existed in their own minds concerning it; and they thought the scheme a wild and dangerous one.

Another concrete instance of this prejudice can be cited here in Philadelphia. On Nov. 28, 1833, a petition signed by several hundred of the excellent people of the city was addressed to "The Honourable the Select and Common Councils of the City of Philadelphia," protesting against the use of gas. In the course of the petition they said:

> The subscribers beg leave respectfully to remonstrate against the plan now in agitation for lighting the city with gas, as they consider it a most inexpedient, offensive, and dangerous mode of lighting. In saying this, they are fully sustained by the accounts of explosions, loss of life, and great destruction of property where this mode of lighting has been adopted. We consider gas to be an article as ignitable as gunpowder, and nearly as fatal in its effects. As regards the immense destruction of property, we believe the vast number of fires in New York and other cities may be in a great measure ascribed to this mode of lighting. The leakage of pipes and carelessness of stopping off the gas furnish almost daily instances of its destructive effects. And when we consider that this powerful and destructive agent must necessarily be often left to the care of youth, domestics, and careless people, we only wonder that the consequences have not been more appalling. It is also an uncertain light, sometimes suddenly disappearing, and leaving streets and houses in total darkness. . . . The constant digging-up of the streets, and the circumstance that the gas-pipes at the intersection of each square must come in contact with the water-pipes, are difficulties and evils which we would anxiously avoid. In conclusion, we earnestly solicit that the lighting of our city with oil may be continued.

If the signers of this petition could appear upon the scene to-day, and witness the splendid achievements of gas under the management of your great Philadelphia Company, I am sure they would be in favour of the "recall," at least in so far as it applied to their petition.

But the opposition to the use of gas should not surprise us. It seems to be a fundamental trait of human nature to oppose, for a time, everything that is new. Coal had the same prejudice to overcome. It does not take long, however, for human nature to get used to novelty; but remarkable it certainly is, considering the difficulties of communication and the meagre resources of a new country, that America was but little behind Europe in the use of gas. The history of the pioneer gas companies of America shows that, in addition to, and to a considerable extent because of, the prejudice that existed against the new and supposedly dangerous illuminant, it was a very difficult matter to secure the necessary capital to erect and operate the plants; and it was some time before the industry was established on a commercially sound and profitable basis.

COMPETITORS OF GAS.

Gas as an illuminant has had several competitors which at the time of their appearance in the field threatened its existence. In the early days of the industry, the gas manufactured had an illuminating value of about 15 to 17 candle power. Compared with the light of candles or of the crude whale oil then in use, it was considered a wonderful illuminant. This superiority was soon threatened, however, by the introduction of kerosene and improved oil-lamps, the general use of which interfered seriously with the rapid increase of the sale of gas. These conditions would have greatly retarded the growth of the industry had not the problem been solved by Tessié du Motay and Lowe—the former a Frenchman and the latter an American—who, independently of each other, were carrying on experiments which were to result in the introduction of the so-called water gas. The investigations of both Tessié du Motay and Lowe were conducted in America; so that the development of the water-gas industry is purely American. The first plant using the Lowe process was erected at Phœnixville (Pa.) in 1873. At present, although the exact figures are not available, the census reports indicate that the amount of water gas sold for public use is about 75 per cent. of the entire quantity of gas sold.

The advent of electricity for lighting purposes did not, as some might suppose, check the progress of gas. On the contrary, as has been the history where improved methods of lighting have developed, both kinds of lighting profited by the increased efficiency; and since the introduction of the incandescent mantle, notwithstanding that the resultant yield of illumination per cubic foot consumed was practically quadrupled, the reduction of gas output did not follow, but, on the contrary, vastly increased. The development of high-pressure incandescent lighting systems, such

as are in vogue in the leading European cities, is another movement which bids fair to keep the gas industry to the fore.

Production and Prices.

The trend of prices for gas has been steadily downward from the beginning. In New York City, for instance, the price in 1826 was $10 per 1000 cubic feet; in 1846, $6; in 1866, $3·50; in 1886, $1·25; in 1897, $1·20; in 1898, $1·15; in 1899, $1·10; in 1900, $1·05; in 1901, $1·00; and in 1906, 80 c.—the present rate. These reductions have been made possible by various economies in production, and particularly by the more extended utilization of bye-products and by promoting the use of gas for domestic and industrial purposes.

Neither gas nor electric light has been a factor in the increased cost of living of which we hear so much. The Massachusetts Commission on the Cost of Living reported that the average price for gas in that State in 1890 was $1·46 per 1000 cubic feet, and in 1909, 91·4 c.—a decrease of 36·4 per cent. in the period. The Commission also reported an increase in the prices of twelve staple commodities from 1897 to 1910 of 51·7 per cent. During the same period, wages also underwent a marked increase. If the experience of Massachusetts may be taken as fairly representative of the country at large, it shows that in a period of steadily advancing prices, both for commodities and for labour, the public has had the advantage of a steadily diminishing price of gas for all purposes.

The output of gas has been continually on the increase, notwithstanding the competition from electricity. From the subjoined table (compiled from the report of the Department of the Interior of the United States Geological Survey, 1902-1908, by E. W. Parker) it appears that in 1898 the companies reporting showed total sales of 18,431,200,000 cubic feet, for which $21,502,325 was received—an average price of about $1·17 per 1000 cubic feet. Ten years later (1908), the companies reporting showed total sales of 156,909,310,000 cubic feet, for which $133,571,122 was received—an average price of 85 c. per 1000 cubic feet.

	Thousand Cubic Feet.	Average Price per 1000 Cubic Feet.	Amount.
433 companies reporting in 1898—			
Sold for illuminating	15,955,149	$1·188	$18,955,144
Sold for fuel	2,476,051	1·029	2,549,181
Total	18,431,200		$21,502,325
552 companies reporting in 1908 (oil and water gas)—			
Sold for illuminating	76,804,546	0·92	70,294,158
Sold for fuel	26,542,951	0·98	26,049,063
Total	103,347,497		$96,343,221
506 companies reporting in 1908 (coal gas)—			
Sold for illuminating	32,485,571	0·73	23,599,930
Sold for fuel	21,076,242	0·65	13,627,971
Total	53,561,813		$37,227,901
Total coal and water gas sold	156,909,310		$133,571,122

The growth in gas output compared with the growth in population shows that the gas sales in large cities grow almost twice as fast as the population. For instance, in four great boroughs of New York City, the 1890 and 1910 censuses compared show an increase in population of 90·6 per cent. in the twenty years; while the increase in gas sales in the seventeen years from 1893 to 1910 was 164·6 per cent., or relatively about 5 per cent. per annum for population and 9·67 per cent. for gas.

Gas Securities.

Gas has unquestionably for many years been a staple commodity; and its growing field of usefulness in industrial work, as well as for cooking, heating, and other domestic purposes, has given gas securities a standing and stability hardly approached by any other class of investment. As has been shown, its ratio in increased output far exceeds the ratio of growth of population. For instance, the United States census shows an increase in the decade from 1900 to 1910 of about 21 per cent. In about one-third of this time—that is, from 1905 to 1908—the sales of gas rose from 117,866 million cubic feet to 156,909 millions; an increase of 39,043 million cubic feet, or 33 per cent. in three years. This would indicate an approximate increase of 100 per cent. in the decade, or five times the ratio of increase given for the population. From this we may conclude that gas securities are destined to maintain a high place as desirable investments It is claimed that no other class of bonds shows such a small percentage of defaults as gas securities. A study of the gross and net earnings of lighting companies shows that the effect of periods of commercial depression such as were experienced in 1907 and 1908 is slight as compared with the effect upon the earnings of general industrials. The variation between the two is very marked for such periods. The earnings of lighting companies show a material gain, while those of general industrials show a decided falling off.

A tabulation covering three years for 61 prominent cities in the United States, all of which have well-established sources of electrical supply, shows an increase in gas consumption from 1899 to 1902 of 31 per cent. In its widening field for industrial purposes, two powerful factors work for its development, the first of which is the fact that it requires no space for storage on the users' premises. Secondly, it is smokeless, and eliminates the troublesome factors encountered in almost all other fuels—the handling of the fuel itself, incidental refuse, ashes, and the like. In view, therefore, of the position of the gas industry, its continued growth, and the variety of purposes to which its services may be put, it is fair to predict that, properly operated, and with constant provision for invention and improvement, the business will steadily increase.

Some Agencies for Promoting the Sale of Gas.

No discussion of the subject that has been assigned me in this series would be complete without a reference to the work of our Commercial Gas Association, which forms a most important connecting-link between the producer and the user of gas. It is conceded that a material factor in reducing the cost of gas production is increasing the output. It is, of course, of vital importance that the product of the plant shall be of the required quality, and that its manufacture and distribution shall be at the minimum cost consistent with quality requirements. This is certainly worthy of the best thought and effort of the technical man; and this work is likely to make such a demand upon his time as to preclude the possibility of his devoting any considerable attention to the commercial problems connected with the industry.

Salesmanship has become a science; and interchange of ideas and the discussion of ways and means for selling the engineers' product make the importance of Commercial Gas Associations loom very large to-day, as it is mainly through the development and extension of this arm of the industry that the problem of enlarging the field of usefulness of gas must be solved.

It is with us as with other industries. If we are to have the highest efficiency, it must be through specialization. I believe the money of a gas company is well spent when it develops specialists in the selling line. And this brings to mind the fact that close observation should be kept over the office man, to see that those who deal with the public are sufficiently well informed, and have the capacity to supplement thoroughly the salesman's work and deal with the public in a satisfactory manner. The commercial gas men have inaugurated aggressive selling campaigns, have instituted schools of salesmanship, and have brought together the manufacturer, seller, and user of gas appliances at their conventions, an important feature of which is the exhibition and demonstration of the latest and best gas-using devices. I understand that a Commercial Gas Association has been formed in London similar to that in America.

I am also a firm believer in the value to lighting companies of newspaper publicity—that is, going direct to the public through the advertising columns of the daily papers, telling, in a plain, straightforward way of our product and our service, explaining the things which to the trained gas man may seem rather elementary, but which to the average man are more or less of a mystery. I know of nothing that is more promotive of good relations between a gas company and the public than a frank declaration of the principles and policies of the company as a public service corporation, made without reservation, and thoroughly lived up to. Following the establishment in this way of a broad foundation of confidence, the company may advertise special appliances or particular features of its service of the more strictly "business-getting" sort, with the certainty that the returns will amply justify the expenditure.

But even to-day a man ushered into the lighting world faces a field filled with sceptics. In the minds of many there is an inherent feeling of bias against the lighting man, primarily, perhaps, by reason of the fact that the average individual has no conception of the commodity we sell, its manufacture, the immensity of the time, money, energy, and skill required to build up a gas-lighting business. And this feeling of distrust is augmented by the fact that the commodity is of so intangible a nature that the buyer of it has no visual knowledge of its coming into his possession as a commodity. To the average man, selling gas is a thing apart from selling light. The commercial proposition of selling our commodity is further handicapped in the operation of selling as compared with other products which may be shown by the seller. It lacks attractiveness in display—in fact, has none in itself—cannot be basketed and bundled-up and carried away by the user who has chosen his purchase for its attractive appearance, has seen it measured by the yard or bushel, or weighed by the pound, and taken in the hand and carried to the house.

The gas man has also inherited a deep-seated antipathy of the user of his product by reason of the uncommercial methods of many of his predecessors in the business. Deal in gas we do, with all classes, all nationalities, all grades of people, and with those who to a great extent commenced doing business with us with this inherited prejudice, we are at once put on the defensive. In dealing with the commercial proposition, we must make a large portion of our work the uprooting of this prejudice; and this does not demand so much of our engineers and gas makers as it does of our commercial department men—those who meet the public, and who are large factors in our service. And this word "service" should show up large before the employee of any public utility corporation. The shortcomings of a supply as to pressure, candle power efficiency, and other essentials, are apt to be the matter of a moment; and when they are remedied in a gracious manner, they leave no rankling. But the shortcomings which are evident in

poor service, brought about by inattention, neglect, or slipshod methods, are not so easily effaced from the consumer's mind. So I say that this word "service" should be writ large in the mind of every worker for a public utility corporation. Some of our ancestors did not appreciate this end of the business as vital to the commercial success of our industry; but we are getting away from old-fashioned methods, and we feel that we have made great strides in this direction in the last few years.

When one reflects upon the truism that "one man on the block makes public opinion," and that there is a large probability of there being at least one unreasonable individual living within the area of a city block, it is not strange, in view of the fact that the satisfied gas consumer does not go to the trouble of announcing his satisfaction from the housetop—that is, not to the extent of disturbing his neighbours or keeping them awake with his joyous ebullitions—that the gas man is on the defensive a very considerable portion of the business day. This is in part because he has allowed an air of mystery to surround his business. He has not given enough time and attention to educational work among his patrons—has not tried to explain the workings of that mysterious black tin box in the cellar of which the average consumer stands in dread, and to whose ear the little clicking noise of its mechanism is so ominous. Happily we are to-day on the road to enlightening our customers by giving to our employees a knowledge of these common things of the business, of which up to a comparatively recent time they were wofully ignorant.

Importance of Light to the Growth of Cities.

As a factor in the growth of cities, it is generally conceded that the lighting company is a positive force for the general good. The importance of its work of providing the public with more and better light is appreciated by all who are connected with the development of municipalities and particularly of suburban districts. The value of light to a municipality from the purely commercial point of view is becoming more and more recognized, as is evidenced by the agitation among merchants the country over for additional street and store illumination. These tradesmen know well the value of illumination, both in the matter of window display and in the general publicity it attracts to the lighted district and to the city as a whole.

Light is the world's best policeman, for crime instinctively seeks the shadows and the dark corners. I believe that many of our American cities could find no better way of co-operating with the efficient police bodies they have than by thoroughly illuminating the communities to the very limit of municipal control.

In "King's Treatise on Coal Gas" we are given this interesting information concerning the early days of gas lighting: "The police officers from Worship Street and other places gave evidence of the great utility of gas lighting in preventing robberies; and they mentioned an instance where a perpetrator of this crime had been apprehended by its aid. Also that three-fifths of the street oil-lamps were extinguished before midnight, and that the thieves would borrow ladders from lamp lighters for the purpose of committing robberies." This was brought out in connection with an application made in London in 1816 by the Chartered Gaslight and Coke Company for an increase in capital.

The Gas Company, the Public, and the Municipality.

I now pass on to deal with the modern gas company in its relation to the public and to the municipality, as a necessity, a convenience, a promoter of trade, and a source of good or ill will as between the company and the community—the last-named largely in proportion to the degree with which the company's affairs are conducted with business sagacity and common sense. It is a public service corporation. Its rights and the rights of the consumer must be safeguarded, if both are to realize beneficial results. It is not a one-sided proposition; one falls unless the other is well supported. They are inter-related; they should be friends, not enemies. It is a mischievous interpretation of their relations that groups all the wrongs on one side and all the rights on the other.

To repeat before such a representative body as that which I am addressing all the arguments for the company and for the consumer is not my purpose, nor is it necessary at such a time. It is sufficient to say that the relation of the company to the municipality should be characterized by integrity and efficiency of management and fair and impartial treatment of all who do business with it. In turn, when the public are fairly and efficiently served—that is, with the best service at the lowest rates compatible with a just estimate of their respective relations—the municipality should support and encourage the company. The public are less concerned with the precise rate they pay than with having thoroughly efficient service. If the company is honestly conducted, and its affairs are given that degree of publicity which is proper and is the public's due, the latter do not begrudge to the company adequate returns, nor will they yield to the screamings of the demagogue and the self-seeker when he misrepresents the facts or encourages unjust attacks. On their side, the companies must keep out of politics, and the mystery of management must become less of an obsession with those who have important undertakings of this character entrusted to their hands.

Of course, all this presupposes full recognition of the rights of employees. No company will have permanent success, or deserve to have it, unless those whose labour has so vitally to do with the enterprise are regarded as an integral part of it. Adequate wages, reasonable hours, generous treatment all along the line, with a system of management that encourages to the highest possible degree the spirit of the individual worker, are all their due, and are recognized by the enlightened corporation.

If there is one thing more than another that is a menace to industrial progress, I believe it is the untenable position assumed by some extremists who would limit the return allowed to such corporations as those which are of the public utility class to a rate so low that it either barely equals the legal rate of interest, or, taking into account the varying factors that must be considered in the case of each company, a rate that is practically but a fraction above confiscation. To induce original investment and development, to ensure progress after establishment, to safeguard both the company and the community, a return not merely theoretically but actually fair and liberal must be permitted, if the normal laws of trade are still in effect; and we believe that they are.

It should be remembered that when franchises were granted to public utility companies they were granted with the idea that a service absolutely essential to the growth of the community was to be provided; and it must also be remembered that in many cases those who obtained these privileges or franchises faced a serious risk in making their investment—that there was no assurance that an adequate return would be forthcoming for the money and energy expended in the building-up of the service.

A factor which the unthinking man should have brought to his notice, when the supposed enormous profits accruing to lighting companies are discussed, is the ratio between investment and gross income. Investigations show that the annual gas sales of many of the American companies do not exceed $15 for each $100 of investment. It must not be inferred from this that these companies make $15 per annum on every $100 investment, but that their actual sales each year amount to but about one-seventh of the money invested. This would indicate an investment of $7 for each 1000 cubic feet of annual sales at approximately $1 per 1000 cubic feet. In other lines of business, it is expected to turn over the capital once, twice, or three times a year; but here is a business, in which millions are invested, in which the capital is turned over only once in about seven years.

It has come to be well-nigh axiomatic in the gas industry that each company must be considered on its merits—that hardship and injustice result when one company is expected to meet all the requirements of the business under the same restrictions as every other. Engineering difficulties, extent of territory, character of population, maximum demand, and a number of other considerations, must in each instance be given their fair and proportionate bearing upon the entire problem. We cannot expect all the desirable factors to which I have alluded to be fully developed at once. Substantial and permanent progress in any industry, in any line of human endeavour, is usually of slow growth. But we can work towards them with the certainty that the material returns will be gratifying, and that we shall be contributing, if only in a slight degree, to the establishment of efficiency and equity and justice in our commercial transactions.

Municipal and Private Ownership.

Public utilities in the United States, in their establishment, development, and successful operation, have resulted almost wholly from private initiative and private capital. There are probably not more than twenty-five municipally owned and operated gas plants in the country. As has been well stated by a Committee of the National Civic Federation reporting on this subject—

> Under a system of municipally controlled utilities it may be expected that operating costs will be, as they have been, materially increased by the demand for preferment and for employment of men whose services are not actually needed. The salaries being fixed by a council dependent upon public suffrage, makes it possible that there be no limit to the number of positions to be created and no control over the remuneration established for them. The rule of municipally owned plants is to cut rates to a point below cost of production, and make no allowance for depreciation; and often no interest is charged off against the investment. Expensive extensions are made to favoured firms; and when the time comes for renewals and repairs, the taxpayer will be asked to appropriate funds from the treasury, or stand sponsor for a bond issue. Economy of operation and advantageous selling are the great factors that must determine the success of any lighting enterprise.

The operations of municipally controlled lighting plants are largely confined to street and municipal building lighting, and do not, as a rule, furnish the citizens as individuals. Consequently they cannot be compared with the operations of a company supplying individual dwellers in a municipality; but where we have an opportunity of making comparisons of somewhat similar lines of operation, the results are certainly not unfavourable to the private companies.

After a few remarks on "Competition *v.* Monopolistic Control of Public Utilities," the author expressed as follows his views on the subject of the

Regulation by Commission of Public Bodies.

If the question of rates is to be determined, in any degree, by a public body, it is a safe proposition to advance that a Public Service Commission, if rightly constituted, would be far better able to decide upon such an important matter than a legislature. With facilities which would be available by a Commission, a more intelligent understanding could be had of conditions which should govern in such matters. The process of finding out by qualified experts, through long and exhaustive research, is not what would be at the command of a legislative body dealing with a voluminous

public business in short sessions. Such a Commission which has gained the confidence of the public and the lighting company is better able, through the investigation of its experts, to cope with this intricate subject than a body which, as a body, has no particular local interest in such a matter as gas-rates.

In the larger communities of America, competitive control of the gas industry has given place largely to monopolistic control; and this tendency received a great impetus in the establishment of State Commissions to regulate and supervise various features of the business. In certain lines of business, regulated monopoly appears to have come to stay; and this is especially true of the gas industry. It is well that this is so, for the industry is certainly one of a class where competitive conditions work not only loss, hardship, and discomfort to the public, but in the weaker companies tend to inefficiency and generally poor service.

But regulation must not mean management; and it will not be construed as in any sense to mean management if Commissions are constituted of competent and broad-minded officials. On the other hand, there cannot, with justice to the public or to the corporations, be left a twilight zone in which neither appears to have jurisdiction. The light of common sense must be made to shed its rays upon the whole question; and when that day has fully dawned, we shall find the exactions upon the corporations less burdensome, and the resistance of the corporations to wise and reasonable requirements eliminated.

Conclusion.

This centenary celebration is a milestone in the progress of one of the world's great industries. These hundred years have given to mankind many of the most marvellous of its processes and of its inventions. In a gathering of this character, we draw upon the past for its history and its lessons. Knowing by these means the character of the pioneers in the gas industry, and of many of their successors by more intimate association, I believe the men of the present are in a position to contribute much to the solution of problems that to-day confront the business community; and, furthermore, I believe they are alive to this opportunity for beneficent public service.

In this time of industrial unrest, the business interests of the country should play a conspicuous and helpful part. Commercial honour is not a rarity, the ethics of trade are not mere memories of a glorious past in the life of the nation. Such generalizations are but the familiar stock-in-trade of the professional agitator or self-seeking politician. But business—big and small, in all its manifold branches—owes its strength, its progress, and its permanency to that ordered liberty whose fostering care it can in no wise so well assure, and when assured repay, as by willing and complete obedience, not only to the law of the land, but to those higher laws without an observance of which we fall far short of our ideals of the true commercial greatness of a mighty people.

COKE-OVEN TARS OF THE UNITED STATES.

We have received from the Director of the United States Department of Agriculture (Mr. Logan Waller Page) a copy of a report made by Mr. Prévost Hubbard, the Chemist in the Office of Public Roads, on the results of examinations of all the coke-oven tars at present manufactured in the United States, together with a brief discussion of their properties in relation to their use as road materials. The report is addressed to the Secretary of Agriculture (the Hon. James Wilson), and is issued as circular No. 97 of the above-named office.

In opening his report, Mr. Hubbard remarks that the rapidly increasing use in America of refined coal tar in the treatment and construction of roads, and the fact that an immense quantity of tar will ultimately become available for this purpose through the installation of bye-product coke-ovens, make it highly desirable to obtain accurate information as to the properties of coke-oven tars which are being produced at present. Coke-ovens in which the bye-products are saved are used to some extent in America; and the author thinks that sooner or later they will undoubtedly replace the old-style oven entirely, and thus enormously increase the output of tar. The reason that they have not been more generally adopted is that in the United States tars are of much less economic importance than in the European countries, where great chemical industries are based upon the utilization of this material.

With the development of the road-tar industry, which promises to consume vast quantities of tar, and the necessity for refining such tars before use, the general adoption of bye-product ovens is only a matter of time. What this will mean in the increase in tar production can be imagined from the fact that in 1908, out of a total of upwards of 26 million tons of coke produced in coke-ovens, only a little more than 4 million tons were obtained from bye-product ovens. About 22 million tons of coke were therefore produced without recovery of the tar. As the average yield of coke per ton of coal was 66 per cent., this would represent the consumption of more than 33 million tons of coal. Upon the basis of a yield of 10 gallons of tar per ton of coal, it may be seen that upwards of 330 million gallons of tar were lost in 1908 which might have been saved. As the actual production of coal tar from coke-ovens and gas-works amounted to about 101 million gallons, it is quite evident that more than three-fourths of the possible production of tar as a bye-product was lost during that year. At a valuation of 2½ c. per gallon, this means a loss of over $8,000,000. With such an increase in production, however, the monetary value of coal tar would have dropped, so that this figure may be somewhat exaggerated. In any event, at a conservative estimate, the tar lost each year from non-recovery coke-ovens is sufficient for 9000 miles of tar macadam road 15 feet wide.

This estimate was based on data taken from reports of the United States Geological Survey. In a later report, it is shown that upwards of 53 million tons of coal were consumed in beehive ovens in 1910; so that, on the same basis, it would appear that more than 530 million gallons of tar were lost during that year. The output of tar from bye-product coke-ovens, however, has also continued to increase, as shown by the following figures taken from the report referred to: In 1908, 42,720,609 gallons; in 1909, 60,126,006 gallons; in 1910, 66,303,214 gallons. The tar thus produced in 1910 was valued at $1,599,453, or about 2·4 c. per gallon. It is evident, therefore, that the value of the tar lost during that year by the use of beehive ovens was approximately $12,000,000. That the use of bye-product ovens is increasing in greater proportion than the use of the beehive oven is shown by the fact that for the former type the increase in 1910 over 1909 in tons of coke produced was 14·13 per cent., while the production from beehive ovens increased by only 4·57 per cent.

In order to determine the character of coke-oven tars at present being produced in the United States, it was first necessary to obtain samples from all the known plants; and for this purpose reference was made to a list of bye-product and retort coke-oven plants operating in the United States and Canada. Letters were written to the owners of each plant asking for the information as to the maximum temperature of the retorts and of the charge of coal, the specific gravity of the crude tar, and the percentage of free carbon found in it. The parties were also asked to furnish, for examination, a 1-gallon sample of the crude tar from each class of oven. Very courteous replies were received from the manufacturers, and in practically every case samples of tar were also forwarded.

The questions concerning temperature were asked because criticism from an authoritive source had been received with regard to a statement made by the author in a former publication, to the effect that in the production of tar from bye-product coke-ovens "carbonization is conducted at a lower temperature than in the manufacture of coal gas. The resulting tar, therefore, contains a smaller amount of free carbon, averaging from 3 to 10 per cent." But little reliable information on this subject could be obtained from published literature, although the opinion seemed to prevail that carbonization in these ovens is conducted at a lower temperature than in modern gas-works practice. The answers given by the manufacturers with respect to this question indicate only an approximate knowledge. In general it may be said that carbonization below 970° C. is considered low temperature; from 970° C. to 100° C., medium temperature; and from 1100° C. to 1540° C., high temperature; and that modern gas-works practice involves high temperatures.

Table I.—*Analyses of Crude Coke-Oven Tars.*

Type of Oven.	Maximum Temperature of Firing Retorts.	Maximum Temperature to which Coal is Brought.	Specific Gravity of Crude Tar.	Per Cent. of Free Carbon in Tar.
	Deg. C.	Deg. C.		
Semet-Solvay.	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1050–1450	950–1150	1·12–1·21	3–12
,,	1250	1150	1·17	5·72
,,	1050	1000	1·16 (20° C.)	..
,,	1250	1150	1·17 (15° C.)	8
Otto-Hoffman.	(*a*) 1100	(*a*) 1200	1·17	8–10
,,	1000	1000	1·10	16–24
,,	(*b*)	(*b*)	1·17	10–15
,,	1111	1111	1·14	(*f*) 16
United Otto.	1666	1444	1·20	7·09–10·64
,,	1333	1222	(*c*) 1·19	(*c*) 8–10
,,	1232	1222	1·14–1·15	4–5
,,	(*b*)	(*b*)	1·207 10° C.	16·59
,,	1222–1277	(*b*)	(*b*)	(*b*)
Koppers.	1444	1388	1·16–1·20	12–15
,,	1100	880–950	(*d*) 1·174 1·169	4·35
Otto-Hoffman.	1000	833	1·20–1·30	7–9
United Otto.	1222	1055	(*e*) (1.221)	(*e*) (7·3)
Otto Hoffman.	1111	(*a*) 1111	1·12	(*a*) 15
United Otto.	1111	(*a*) 1111		
,,	1000	1000	1 16	16–24
Rothberg.	1000	1000		

(*a*) Approximately. (*b*) No information. (*c*) Varies with coal. Coal with 28 per cent. of volatile matter used. (*d*) With H_2O. (*e*) At present. (*f*) Variable.

From a total of 31 manufacturers to whom the questions were submitted, 30 replies were received; but four of these reported their plants as not in operation. The remaining 26 furnished

samples of their crude tar for examination, and answered the questions in so far as they were able. Upon receipt of each sample the entire contents of the package were thoroughly mixed, and a representative sample taken for analysis. The information furnished by the manufacturers is given in Table I. In it the different tars are grouped according to the type of oven in which they were produced. It will be noticed that the statements relative to the maximum temperature to which the coal is brought during distillation indicate that two of the plants run below 970° C., that a total of 22 run not over 1150° C., that nine run from 950° C. to 1150° C., and that only five run above 1150° C. The maximum temperature of firing the retorts is, however, reported in most cases as being higher than the maximum temperature to which the coal is brought. The maximum amount of free carbon reported is 16 to 24 per cent.; but 17 manufacturers gave it as 12 per cent. or less, and only four as 16 per cent. or more.

Analyses of the samples received were made in the office of Public Roads. The work consisted in determining the specific gravity, free carbon, material soluble in carbon disulphide, percentage of ash, and percentage of different fractions obtained by distilling a 250 c.c. sample in a 750 c.c. tubulated glass retort with the thermometer so placed that the top of the bulb was level with the bottom of the juncture of the stem and body of the retort. The specific gravities of the samples ranged from 1·133 to 1·214; and the great majority were lower than 1·200. This in itself indicates low percentages of free carbon. The minimum percentage of free carbon was 2·73; the maximum, 16·80; the average for the 26 samples, 8·38. Eighteen samples contained less than 10 per cent. of free carbon, and 8 more than 10 per cent. About two-thirds of these products might, therefore, be considered as low-carbon and the other third as medium-carbon tars. The amount of ash in no case exceeded 0·16 per cent.; and in most cases it was practically *nil*. This is, of course, also true of practically all gas-works coal tars. The quantity of water present varied from a trace to 10·1 per cent. by volume; but in only three instances did it exceed 5 per cent. Fourteen of the pitch residues remaining after distillation had been carried to 315° C. were either soft or plastic—a condition which has seldom been noticed by the author in the distillation of gas-works coal tars. The amount of solids which crystallized or precipitated out of the different fractions was found to vary greatly.

TABLE II.—*Analysis of Coke-Oven Tars upon a Water-Free Basis.*

Type of Oven.	Percentage of Free Carbon.	Fractions by Weight.				
		Percentage up to 110° C.	Percentage from 110–170° C.	Percentage from 170–270° C.	Percentage from 270–315° C.	Percentage of Pitch.
Semet-Solvay	7 82	0·30	0·70	11·59	7·35	79·73
,,	8·84	0·30	1·71	12·39	6·95	78·22
,,	7·21	1·55	0·60	13 33	10·70	73·83
,,	6·19	1·21	0·60	19·18	4·97	73·60
,,	4·73	1·30	0·60	15·57	8·44	74·07
,,	7·49	0·30	0·90	20·70	8·90	68·90
,,	6·97	2·44	0·31	13·81	6·05	76·51
,,	6·28	2·17	0·51	16·04	10·76	70·08
,,	9·00	1·42	0·20	18·10	5·79	74·36
,,	5·19	1·95	0·30	16·76	6 99	73·55
,,	4·04	1·32	0 81	19 89	12·75	63·87
,,	7·09	1·02	0·20	14·50	8·43	75·30
Otto-Hoffman	14·22	2·34	0·51	20·81	14·69	60·91
,,	14·69	1·46	0·10	11·40	8·47	78·03
,,	11·12	1·54	0·51	24·89	6·89	65·32
,,	8·62	2·57	0·61	25·15	3·60	66·90
United Otto	7·96	1·21	0·40	10·30	9·79	78·28
,,	8·60	0·91	0·40	15·29	8·61	74·16
,,	5·26	0·91	1·31	21·63	10·51	65·41
,,	10·63	0·90	0·40	23·83	6·36	68·28
,,	12·55	1·34	0·30	16·39	11·44	69·89
Koppers	3·95	1·21	0·20	18·29	12·19	67·37
,,	2·81	1·03	0·30	19·07	6·70	72·37
Otto-Hoffman and United Otto	11·51	1·42	0·50	18·55	7·64	71·45
,,	13·52	2·50	0·21	6·65	7 52	81·57
United Otto and Rothberg	17·17	0·30	1·73	10·12	10·42	76·68

The results given in Table II. are calculated upon a water-free basis—*i.e.*, the percentages are expressed in terms of the actual tar exclusive of water. Considering these products according to type, it will be seen that the tar produced by the Koppers ovens contains the lowest percentage of free carbon, the Semet-Solvay tars the next lowest, the United Otto next, the Otto-Hoffman next, and the mixed tar from the United Otto and Rothberg ovens the highest percentage of free carbon. For the sake of comparison, the minimum, maximum, and average percentages of free carbon for each of these types are shown in Table III.

TABLE III.—*Percentage of Free Carbon in Coke-Oven Tars.*

Type of Oven.	Min.	Max.	Aver.
Koppers	2·81	3·95	3·38
Semet-Solvay	4·04	9·00	6·74
United Otto	5·26	12·55	9·00
Otto-Hoffman	8·62	14·69	12·16
Otto-Hoffman and United Otto (mixed)	11·51	13·52	12·51
United Otto and Rothberg (mixed)	17·17	17·17	17·17

The percentages of various fractions for the different types of tars overlap to such an extent that no detailed comparison will be made. The minimum, maximum, and average total distillates to 315° C. for the different types are, however, given in Table IV.

TABLE IV.—*Percentage by Volume of Total Distillate to 315° C. in Coke-Oven Tars.*

Type of Oven.	Min.	Max.	Aver.
Koppers	30·5	36·0	33·3
Semet-Solvay	22·6	40·8	29·9
United Otto	25·6	38·5	32·6
Otto-Hoffman	25·3	43·6	36·0
Otto-Hoffman and United Otto (mixed)	19·9	32·1	26·0
United Otto and Rothberg (mixed)	26·9	26·9	26·9

From this table it is evident that wide variations exist in the relation of total distillate to pitch residue in the coke-oven tars produced in America; and this is even true of different tars produced by the same type of oven.

Straight coal-tar road binders or refined coal tars are usually manufactured by subjecting the crude material to a process of distillation with or without steam or air agitation. Distillation is carried to the point at which the residuum remaining in the still has obtained the desired consistency at normal temperatures; and this involves the removal of certain of the more volatile oils present in the crude material. For use in construction work, a soft and almost fluid pitch is often produced; and the consistency of this pitch is controlled by means of a melting-point or float test. When the crude tar runs abnormally high in free carbon, it is sometimes mixed with crude water-gas tar before distillation. This tar contains a very low percentage of free carbon; and by properly proportioning the two, a product is obtained, upon distillation, which does not carry more than the maximum limit of free carbon set by manufacturers. What the maximum limit should be is a much mooted question among those who have given thought to this matter. The governing considerations are: (1) What is the most economical limit from the standpoint of manufacture? and (2) What is the proper limit with regard to the utilization of the product as a road material? For a number of reasons, an excessively high-carbon tar is difficult to distil properly, and, with other things equal, the lower the percentage of carbon the easier and shorter the distilling process. From this standpoint, therefore, bye-product coke-oven tars are well adapted to the manufacture of road binders. Moreover, because of their low percentage of free carbon, they may be employed in a manner similar to water-gas tars, when it is desired to utilize a crude high-carbon tar to produce a medium-carbon tar road binder.

In an ordinary road tar for use in construction work where free carbon is present to the extent of about 20 per cent., the proportion of total distillate below 315° C. to pitch residue is approximately 1 : 4. Where this relation exists, the pitch residue is hard and very brittle. A residue which is soft or plastic is to be preferred, as it would indicate longer life during service; and where such a residue is present, the proportion of distillate would naturally be lower for a given consistency, as the distillates may be considered as fluxes for the residues. If such is the case, it is evident from the foregoing tables that coke-oven tars offer a valuable source of supply for tar road binders. In conclusion, the author says that indications point strongly to the fact that bye-product coke-ovens will eventually play a most important part in the road-material industry; and he expressed the hope that their general adoption in America will be rapid. The future demand for economical bituminous road binders in the United States will, he considers, undoubtedly exceed the supply, and this spite the natural increase in petroleum and asphalt road binders.

LEAKAGE IN CAST-IRON WATER-PIPE.

The subject of the loss of water by underground leakage in pipes was dealt with in a paper read before the Ohio Engineering Society by Mr. E. G. BRADBURY, of Columbus (O.). The following digest of it appeared recently in "Engineering Record."

The quantity of leakage from any system is affected by the total quantity of water supplied only in so far as larger quantities of water supplied imply greater and more concentrated population, which, in turn, affects the leakage by reason of the greater number of service-pipes required, and the greater amount of underground work tending to disturb the pipes. A very large proportion of sub-surface waste is due to defective service-pipes; and it is therefore reasonable to expect proportionately more leakage in a closely built-up city than in a smaller municipality. A more rational method of comparison of the loss in various cities than in terms of percentage of the total supply or leakage per head is afforded by figures giving the loss per mile daily, or, better still, the loss per mile per inch of diameter or per foot of lead joint. The length of lead joint per inch mile is from 115 to 125 feet, according to the number of valves and specials.

The enormous leakage in the larger cities has become a matter of serious concern; and extensive surveys have been made, or are in progress, in New York, Chicago, Philadelphia, Washington, and other centres of population, which, though expensive, have usually resulted in the detection and stoppage of leaks aggregating quantities of water so great as to justify the cost many times over. In Washington during the year ended June 30, 1910, a loss amounting to 6,364,000 gallons per day was stopped; and similar results have been accomplished each year since 1908. In Chicago, the

loss from waste and leakage is estimated at 70 to 80 per cent. of the total supply; and one 12-inch main leaked 1,638,000 gallons per day in a distance of 15,000 feet, nearly half of which was within one block. In the 25·8 miles of streets tested for leakage prior to laying pavement, 5,243,000 gallons per day were found flowing away from defective joints, services, &c. Professor Bemis reported in 1909 that waste in Cleveland had been reduced by the installation of meters, pitometer tests, and aquaphone surveys, to 7 per cent. of the total supply, or 6·39 gallons per head daily. The quantity still unaccounted for is about 3,450,000 gallons per day; and it is claimed that no city of more than 50,000 population can make so good a showing. It is indeed an exceptional system, according to Mr. Bradbury, which, after lying in the ground a considerable number of years, does not lose from 20 to 40 per cent. of the water supplied to it.

It is difficult to find reliable data as to the proportion of the total leakage which escapes from the joints of the street mains in operating systems. There appears to be a very general impression among those who have conducted surveys and examinations, according to Mr. Bradbury, that the joint leakage is small; most of them dismissing the subject with the statement that such loss is comparatively unimportant. It is unquestionably true that the greater part of the underground waste is chargeable to service connections and pipes; but nevertheless the leakage from mains is a matter of moment, though frequently lost sight of to a considerable extent on account of the more serious losses elsewhere. The most positive statement at hand, showing the relation of joint leakage, is contained in reports of the Engineering Department of the District of Columbia for 1908, 1909, 1910, and 1911. From a complete classification of underground leakage due to various causes, the figures in the following table are condensed.

Detected Leakage in Gallons per Day.

Year.	Total Underground.	From Services.	From Joints in Mains.	Joint Leakage per Cent. of Total Leakage.
1908 ..	4,243,900 ..	2,729,000 ..	1,013,900 ..	24·00
1909 ..	6,653,635 ..	4,956,515 ..	1,345,620 ..	20·2
1910 ..	6,364,000 ..	3,640,000 ..	1,034,000 ..	16·2
1911 ..	6,921,916 ..	2,746,542 ..	2,562,461 ..	37·1
Total	24,183,451 ..	14,072,057 .	5,955,981 ..	24·6 aver.

In an effort to secure first-hand data, Mr. Bradbury sent to 66 water-works superintendents of Ohio a blank form relating to leakage from water-mains. Thirty replies were received, showing a domestic consumption per head of from 30 to 225 gallons per day, after deducting railroad and manufacturing use. Cincinnati reported an estimated leakage of 12 per cent.; Springfield, 5 per cent.; and Toledo, 50,000 gallons per day, with a total consumption of 16,500,000 gallons. All others felt confident that there was practically no leakage in their systems, though in only six of the thirty had any tests ever been made. The opinion of all was that there should be practically no increase within twenty years. General confidence in the tightness of the pipe systems, Mr. Bradbury has found, is probably typical of the judgment of a great majority of those having charge of this class of works, without reference to the consumption per head.

In considering the statistics of water unaccounted for, it is necessary to bear in mind that, except in cases of actual tests by means of some type of apparatus for the actual measurement of the water entering the system, there are opportunities for more or less error. Perhaps the principal cause of inaccuracy is failure to take into account sufficient slippage of pumps, when estimating consumption by pump displacement. Mr. Bradbury states that probably few pumps operate with less than 4 to 5 per cent. slip; and it is not unusual to find from 10 to 30 per cent.

From experience with a number of pipe systems, the author has become convinced that, under ordinary conditions of pipe laying, it is improbable that the leakage in a new system will be greatly less than 3000 gallons per mile daily, unless it is carefully tested, and all defects remedied. By testing in the open trench, under a pressure at least 50 per cent. in excess of the maximum static pressure expected in the pipe, recaulking all dripping joints, and replacing defective pipe, it is possible to reduce leakage to an extremely low figure.

Reliance cannot be placed on the behaviour of the pressure-gauge in judging the tightness of pipe. The gauge may, under certain conditions, drop rapidly when there is no leakage, owing to failure of the gates to close with absolute tightness, or perhaps be due to air contraction or absorption. It may stand up fairly well to pressure when there is considerable loss, if a large amount of air has become entrapped, and has reached its minimum volume.

Water is reduced by 1-21,740th of its volume per atmosphere. Taking the case of a 6-inch pipe 1000 feet long as representing the average section under test, the volume of water contained is 1470 gallons if the pipe is completely filled. If this water is under pressure, 1470 ÷ 21,740, or 0·065 gallon, must be lost in order that the pressure may drop 15 lbs. Experiments by the writer indicate that 16,000 drops from metallic surfaces are approximately equal to a gallon; and on this basis 70 drops would necessarily escape from the pipe referred to for each loss of 1 lb. pressure. With first-class caulking, the average loss from 1000 feet of pipe before testing is 200 drops per minute, equivalent to about 90 gallons per mile per day. By going over the joints, leakage may be reduced to a point where there is no visible dropping or escape of water; and pressure can then be maintained for a considerable length of time, if the pipe is free from air.

During the summer of 1911, the attention of Mr. Bradbury was particularly called to the subject of his paper by his connection, as Designing and Supervising Engineer, with the water distribution system of the village of Grandview Heights—a suburb of Columbus. An arrangement was made by this village to purchase filtered water from the Columbus Water-Works at a net price of $1·20 per 6200 gallons. The necessity for the tightest possible work was obvious; and specifications were drawn requiring that all pipe should be tested in the open trench, under a pressure of 150 lbs., to the satisfaction of the engineer. The system comprises 5719 feet of 12-inch pipe, 7701 feet of 8-inch, 16,508 feet of 6-inch, 75 valves, 36 hydrants, and 2 air-valves. Every section of pipe was tested and gone over until no evidence of leakage was visible with all pipe exposed.

After completion, a number of observations of the water entering the system were made by means of a 1-inch meter. Two service-pipes were connected with the system during these tests. The amount passing the meter varied; the minimum being 60 and the average 155 gallons per day. The working pressure on the system varies from 45 to 90 lbs.; averaging about 65 lbs.

On the completion of the system, a 6-inch meter was installed at the Columbus Water-Works pumping-station for the measurement of all water sold to the village. The meter was new, and was carefully tested by the city department and stated to register accurately down to the smallest stream provided by their testing apparatus—viz., 1-32nd inch. It is, however, probable that there would be some under-registration in case of very small flow. During the first month's operation, only two services were connected, and the quantity of water registered by the meter was 3720 gallons, equal to a little less than 27 gallons per mile per day, including whatever may have been used by the two consumers. Soon after this, 80 taps were made. After an interval of about two months, the city meter and all individual meters were read. The amount of water passing the 6-inch meter for the period of 58 days was 151,720 gallons; and the sum of the readings of the house meters was 243,660 gallons. During this period, an extension of 550 feet was made, and water was used to settle the trench to the amount of 744 gallons; leaving a quantity unaccounted for of 2·3 gallons per day per mile. The amount of water supplied to the village was equal to 17·5 gallons per consumer per day, reckoning the average number connected for the entire period. The population is suburban, and the use purely domestic. Mr. Bradbury believes that few complete systems have been installed with as low a leakage as this. The value to this Municipality of a tight system is, of course, much greater than to cities pumping their own water; the net cost of water being slightly over 16c. per 1000 gallons for each 1000 gallons per day per mile lost. The actual cost is about $320 per annum, which, capitalized at 4 per cent., amounts to an investment of $8000; or, in other words, if the system had a leakage of 1000 gallons per day per mile (which is considerably below the probable average in similar systems), the village could afford to spend $8000 if, by so doing, the leakage could be reduced to the present amount.

The value of tight water-pipes to a city pumping its own supply is less readily computed. Fixed charges, attendance, &c., are not materially affected by moderate leakage, except that additional capacity is required at an earlier date. The fuel bill, and, in the case of treated water, some items of the cost of purification, are chargeable in proper proportion to such leakage as may exist. It may be safely stated that the cost of careful inspection and testing is always more than justified by the saving accomplished.

With regard to the amount of leakage permissible in new work, general practice would appear to justify anywhere from 60 to 250 gallons per day per mile per inch of diameter, according to Mr. Bradbury. Mr. Gregory, in the improvements to the Columbus water supply, specifies the following limits of allowable leakage under about 110 lbs. pressure:

Size. Inches.	Gallons per Hour per Lineal Foot.	Equivalent in Gallons per 24 Hours per Mile.	Gallons per 24 Hours per Inch-Mile.
20 ..	0·08 ..	10,138 ..	507
24 ..	0·10 ..	12,672 ..	528
36 ..	0·15 ..	19,008 ..	528

These requirements would seem to Mr. Bradbury to lean far towards liberality; and he is of the opinion that, except under particularly unfavourable conditions, it is possible to reduce the loss to a very low figure—so low, indeed, as to be almost negligible. Open trench testing, and rigid insistence on the closing of all visible leaks, will accomplish this result; and by no other means can it be done. It is better, he thinks, to specify this test than to state figures of permissible leakage, as results far better than one would feel justified in specifying are possible, and one cannot demand better work than is required by the specifications.

High-Pressure Gas at Ashton-under-Lyne.—From an account which appears in a local paper, it is evident that high-pressure gas has "caught on" at Ashton-under-Lyne; a hundred lamps having been fixed during the last few weeks in certain parts of the town. It is added that the lights have proved a great attraction to visitors, and that credit is due to Mr. Joseph Townsley, the Gas Manager, for the introduction of this system of illumination into Ashton. A central compressor-house has been provided; and the special mains already laid will be added to in due course. Advantageous terms are offered by the Gas Company to users of these high-pressure lights.

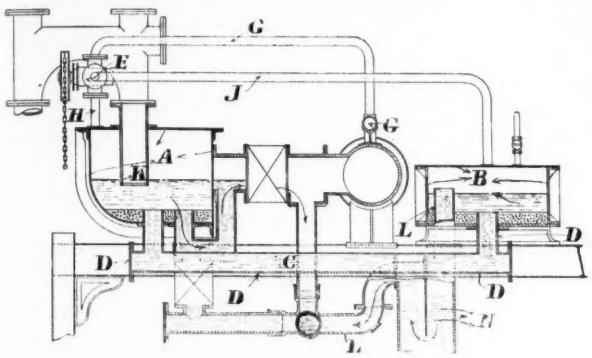
REGISTER OF PATENTS.

Working Hydraulic Gas-Mains.

SMITH, F., of Weymouth.

No. 10,660; May 2, 1911.

This means for sealing dip-pipes when retorts are opened and for unsealing them when retorts are closed, is of the kind in which there is used a separate sealing-chamber in liquid communication with the hydraulic main, and to which gas under pressure is admitted for varying the liquor level.



Smith's Hydraulic Main Arrangement.

The patentee provides to each section of hydraulic main A a closed, gas-tight reservoir B, containing liquor, and connected with the seal in the hydraulic by a pipe D joining the two vessels at points below the level of required seal. Also each section of main has a small three-way valve E operated by a chain or other means. With the inlet of the valve is connected the pipe G, the other end of which is inserted in the gas-mains at a point beyond the exhauster outlet, so that a pressure of gas is always available in the pipe. Another branch of the valve E is connected by a pipe H to the hydraulic main at a point above the required level of seal; while the third branch is connected to the reservoir chamber B by a pipe J at a point above the seal in the chamber.

When the plug of the valve is in a position to make open connection between the hydraulic and the reservoir, the pressure above the liquor in the vessels is equal; and as they are connected together at the base by the pipe D, the liquor in each is at the same level. By simply altering the position of the plug in the valve E, the pressure in the inlet pipe G is brought to act, through the pipe J, above the level of the liquor in the chamber B. The connection between the main and the chamber being closed, the pressure through the pipe J depresses the liquor in B, in consequence of which the level of liquor in the hydraulic is raised by the liquor being forced through the pipe D.

By adjustment of the pressure in the inlet pipe G to the valve E (which can be carried out by an ordinary governor, or other known means, also by arranging the area of the reservoir B), it is possible to provide for any required rise and fall of liquor needed to seal the dip pipes in the hydraulic main, likewise to arrange the working levels so that the liquor condensed from the passing gas is not sufficient to seal the pipes K between the intervals of charging the retorts.

Any surplus liquor condensed from the gas into the hydraulic, or liquor poured into the main for flushing purposes, flows away to the tar outlet pipe, by way of the opening in the base of the hydraulic and the usual tar outlet chamber and weir valve. Any surplus liquor from the chamber B overflows through the pipes L and the seal-box N. The pipes L are connected up with the usual main tar outlet pipe.

Manufacturing Illuminating Gas.

BRONDER, G. A., of Brooklyn, U.S.A.

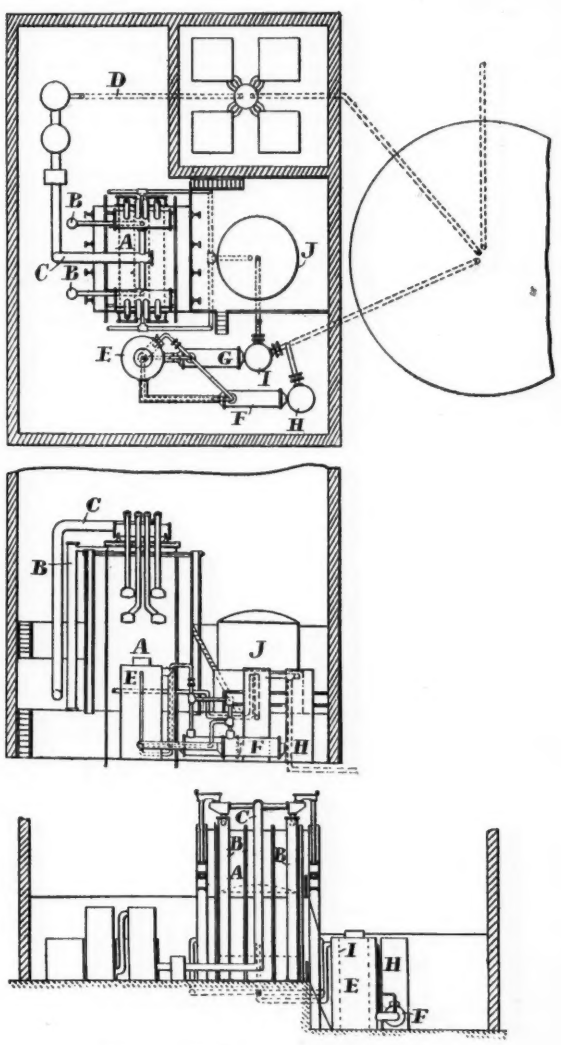
No. 10,325; April 28, 1911.

This invention relates to a process whereby mixtures of coal gas and water gas are manufactured by utilizing the coke produced from a charge of coal to produce water gas to be mixed with the coal gas produced from the charge of coal. One of the objects aimed at is to provide a method of making such a mixture wherein "the utmost advantage is taken of the calorific values of the bye-products" in the manufacture of the mixtures; the bye-products being, so far as possible, employed to assist in the generation of the gas mixture with a view to economy in running the plant. Another object is to provide a method which will "avoid certain inconveniences in regard to the purification of the coal gas, whereby to economize in the practice of the process to which the coal gas is subjected for the purpose of recovering such values as coal tar present as impurities therein."

Accordingly, the coke resulting from a charge of coal is utilized to produce water gas, the entire quantity of which is mixed with the coal gas produced from the charge of coal, and the semi-water gas produced in the treatment of the coke is utilized to heat the coal-gas retorts. The invention also consists in distilling a definite quantity of coal in a retort, washing and purifying the coal gas thereby obtained, collecting the washed and purified coal gas in a holder, heating the entire residuum of coke obtained from the retort to a state of incandescence, alternately forcing superheated steam and steam and air through the incandescent coke to obtain alternate charges of water gas and semi-water gas, washing the water gas, mixing it with the coal gas in the holder, and conveying all the semi-water gas to the retort for heating it.

The semi-water gas, which is fired to heat the coal-retort, and which is produced in the treatment of the coke to generate the water gas therefrom, is stored in a holder before being conveyed to the retort; and the water gas and the semi-water gas are both treated in the same scrubber.

The improvements in question are described by the inventor with reference to the following example: Taking an original unit of 200 lbs. of bituminous coal and heating it to the required degree in a retort, we can produce 1000 cubic feet of illuminating gas of a calorific value of 620 B.Th.U. per cubic foot of gas, with a residuum of 133 lbs. of coke and a portion of tar, ammonia, naphthalene, and some other elements. The residuum of 133 lbs of coke can be subjected to steam to produce water gas; and 3000 cubic feet of the latter gas are produced, having a calorific value of 323 B.Th.U. per cubic foot. During the process of producing the water gas, the coke must be alternately brought to a state of incandescence by injecting a mixture of air and steam, producing a semi-water gas; and in the present instance, about 2100 cubic feet of semi-water gas are produced having a calorific value of 140 B.Th.U. per cubic foot. Now, in accordance with one feature of the invention, this 2100 cubic feet of semi-water gas produced as a bye-product may be used for firing the retorts when generating the coal gas from the original unit of coal, and for heating the boilers of the plant and the like.



Bronder's Mixed Coal and Water Gas Plant.

There are thus produced (as already described) 1000 cubic feet of coal gas from the original 200 lbs. of coal, with its calorific value of 620 B.Th.U. per cubic foot, and the 3000 cubic feet of water gas, with its calorific value of 323 B.Th.U. per cubic foot. So that a mixture of the 1000 cubic feet of the coal gas with 3000 cubic feet of the water gas produces 4000 cubic feet of mixed gas with a calorific value of about 400 B.Th.U. per cubic foot. This mixture of gas is a commercial product of cheap first cost and useful for power and heating, and also for illuminating purposes when ordinary mantles are used. The mixture is compressible to a high degree; and but a small amount of water is condensed from it with low temperatures—in fact, low temperatures affect it but little. Water gas alone can hardly be detected by the sense of smell; but the "novel mixture described" has a strong odour, and can easily be detected in case of leakage.

Various appliances may be employed to carry out the invention, one form of which is illustrated. The retort-stack A is provided with the retorts communicating with upwardly extending stand-pipes leading to the hydraulic mains connecting with the tar-towers B. Piping connects these mains with the coal-gas main C. The latter leads to the exhauster, condenser, and scrubber-washer as usual. The gas-main D, leading from the scrubber, is somewhat reduced in diameter, and leads

through a centre valve to the purifier-boxes. From a compartment in the centre valve extends piping leading to the gasholder.

A gas-generator E is located in front of, and adjacent to, the retort-stack, so that hot coke from the latter can gravitate into the generator. A conduit for hot gases extends from the lower end of the generator and connects with the boiler F; and a conduit extends from the upper end of the generator and connects with a second boiler G. The domes of the two boilers are connected; and piping runs into the lower end of the gas-generator, as also to the upper end of it. The boilers are connected with the condensers and scrubbers H I respectively. A semi-water-gas holder J is located adjacent to the retort-stack, and piping connects the condenser and scrubber I with it.

To operate the plant to make the gas mixture, soft gas coal is charged into the retorts, where it is heated by means of the semi-water gas made in the generator. The coal gas is first conducted through the stand-pipes, where the tar is extracted and flows into the tar-towers B. It then travels through the mains C by means of the exhauster, and is afterwards forced through the condenser and scrubber-washer. From the latter the gas is led to the centre valve, whence it passes through the purifying-boxes on its way to the holder.

The whole residuum of coke in the retorts is discharged into the gas-generator E, where it is brought to a state of incandescence by injecting air through it. When generating water gas, the incandescent coke in the generator is alternately subjected to jets of superheated steam entering the bottom as well as the top of the generator. The water gas produced is led through the boiler G and the condenser and scrubber I, from which latter it enters the main holder.

When it becomes necessary to revivify the bed of coke after producing a charge of water gas, a mixture of air and steam is introduced into the generator. Semi-water gas is thereby produced, which is led into the semi-water-gas holder J, and thence to the retorts.

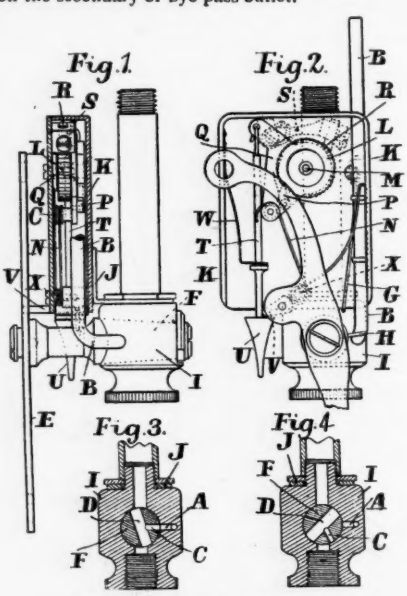
Gas Igniting Apparatus.

ROSTIN, H. P., of Tottenham.

No. 9651; April 20, 1911.

This apparatus for lighting gas consists of mechanism operated by the movement of the gas-cock to create sparks for lighting the gas at a bye-pass; so that the gas supply to the burner is first established, then the pilot light, which is ignited by the sparks, lights the gas at the burner, after which the pilot light is cut off.

An ordinary gas-cock (figs. 3 and 4) is provided with a second gas outlet or bye-pass A, which leads to a bye-pass tube B and is opened when the plug, which is provided with a second passage C, is turned on for the regular passage D to be over the fullest extremity (fig. 3), and only as long as the lever E of the plug F is being held in this position—for instance, by clockwork or an apparatus worked by gas or air pressure. The lever is controlled by a spring G, which acts against a lug H on the plug F, and, when released, the plug turns slightly back and shuts off the secondary or bye-pass outlet.



Rostin's Gas Igniting Apparatus.

The igniting arrangement to the gas-cock casing I is connected by a clip J attached to its frame K, in which a wheel L is mounted having a toothed or rough edge on one side and revolving on a spindle M in close proximity to the bye-pass outlet or to holes in the bye-pass tube B. This wheel is rotated, by a spring N, by means of a pawl P on a frame Q acting on teeth on another part of the wheel, and which frame is also pivoted on the axle M so as to rub against a piece of mineral or alloy R attached to a spring-controlled arm S pivoted to the casing K. This produces sparks through friction, and the sparks ignite the bye-pass gas, which, in turn, ignite the gas at the burner. Depending from the frame Q is a rod T having a cone-shaped end U, against which a nose V on the lever E acts; and the rod T is held pressed against the nose by a spring W secured to the frame K. The spring N is held to a pin X, and one end controls the frame Q while the other has action against the casing K.

In fig. 2, the position of the operating parts indicates that the gas is shut off from both burner and bye-pass tube. To light the gas, the top end of the lever E is pulled down until it is approximately horizontal; and in so doing the nose V presses upon the top of the cone-shaped end U of the rod T, and pushes it downwards—drawing the frame Q around on its pivot M, the pawl P riding over the teeth of the wheel L, which is held stationary by the grip of the mineral piece R, which is pressed against the wheel by a spring acting on the arm S. During this movement a stop on the frame Q has acted upon the spring N and put it in tension.

Just before the completion of the movement of the lever E, the gas-plug has been turned as in fig. 3. Immediately after the nose V has slipped the cone-shaped end U, the spring N turns the frame Q back and lifts the rod T. At the same time, the pawl P engages the wheel L, and moves it round quickly; the teeth or rough edge of the wheel L rubbing against the mineral piece R, and producing sparks to ignite the gas at the burner.

During the movement of the lever E, the pin H acts against the spring G secured to the casing and puts it in tension; and on the release of the lever E, after having been pulled its full distance, the spring returns the bar E a short distance only, leaving the plug full on to the burner with the bye-pass cut off.

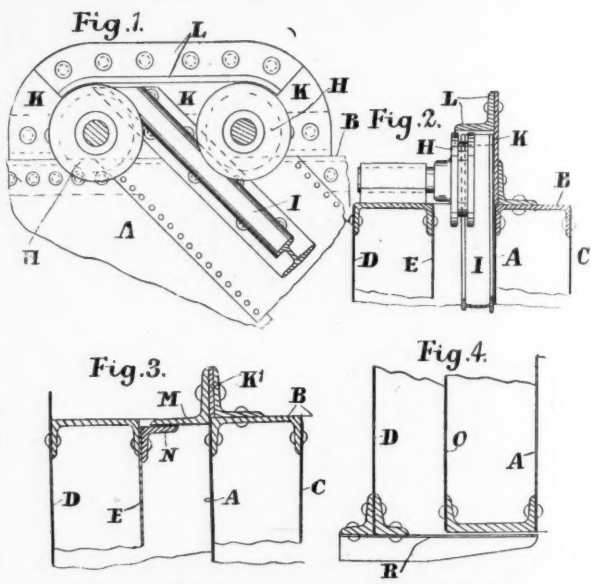
To extinguish the burner, the top end of the bar E is pulled so as to overcome the strength of the spring W by the nose riding over the cone-shaped piece U until it reaches the position shown in fig. 2, when the gas to the burner is cut off and the spring returns the piece U to a position beneath the nose V.

Gasholders.

SCOTT, J. W., of Heaton Chapel, near Manchester, and BEARD, G. F. H., of Crumpsall, Manchester.

No. 2899; Feb. 5, 1912.

This invention, relating to spirally-guided gasholders, has for its object to provide means whereby the fall of the inner lifts is "prevented from becoming undesirable in extent"—say, for example, when the outer lift or intermediate lifts become jammed, and the gas pressure in the holder continues to be, or is, abnormally reduced. Under these conditions, and in the case of gasholders as at present constructed, the consequent uncupping of the inner lifts may result in them falling, more or less, through the adjoining lift, "with disastrous effect." In order to put a "desirable limit" to the extent of fall of each lift, the inventors provide supporting means or stops for the lifts, so arranged that each lift cannot descend beyond its normal working distance within the one adjacent and external to it.



Scott's and Beard's Improvement in Spiral Gasholders.

Fig. 1 is a sectional elevation of a portion of the external surface of an inner lift of a spirally-guided gasholder, with spiral rail thereon, and upon which figure is superimposed a pair of rollers belonging to an outer lift adjacent to the inner lift. Fig. 2 is a sectional elevation taken at right angles to fig. 1. Figs. 3 and 4 show sectioned parts of an inner and outer lift with modifications of the invention applied to them.

In figs. 1 and 2, A is the ordinary side or sheeting of the inner lift, and B is the top part of the lift. C is a portion of the sheeting forming the dip for engaging the cup part of a further inner (or may be top) lift of the holder—not shown. D is the ordinary side or sheeting of an outer lift; and E is a portion of the sheeting forming the dip. The inner lift is thus shown descended within the outer lift. H are a pair of rollers mounted upon the latter; and I is a spiral rail mounted upon the former, and engaged by such rollers.

According to one form of this invention, an extension or plate K is suitably attached to the inner lift, being formed with, or having attached to it, a projecting piece or abutment L, for making contact with the rollers when the inner lift descends low enough for this to take place. By extending the length of the projecting abutment L so as to overhang the roller peripheries, and suitably shaping the projection, it could be arranged to make contact with the roller carriages, or with the top part of the outer lift between the rollers, instead of making contact with them as indicated.

It will be seen that any lift becoming jammed, and the adjacent lifts running down within them, the downward movement is limited by the

stop L; and in some cases the contact may result in the suspended lift becoming released.

It is obvious, the patentees remark, that each inner lift of a number in one holder may be similarly provided for the purpose described, and that a number of such abutments may be arranged around each of the lifts, or the extent of a single abutment be made as great as suitably desirable.

In place of the piece L, the rail I could be extended and bent round to form an abutment.

Referring to fig. 3, an extension K^1 is shown, provided with an abutment piece M, capable of making contact with another abutment piece N connected to, or formed with, the part E of the outer lift. The abutment piece could be extended to make contact with the top or other suitable part of the outer lift instead of as shown; and the contact last referred to could take place at parts situated between rollers.

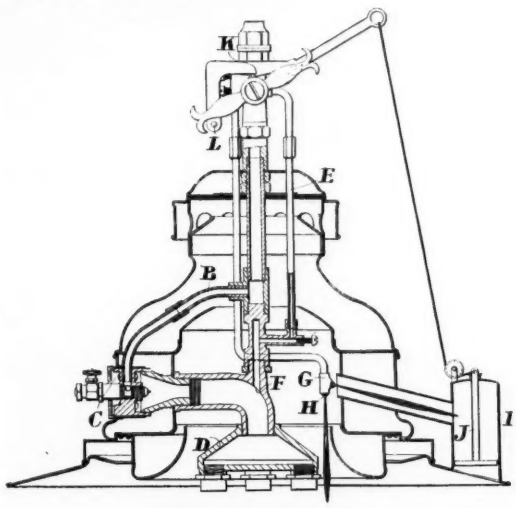
In fig. 4, O is a portion of the sheeting forming the cup of the inner lift; the base portions of the inner and outer lifts being indicated. The lower part or bottom curb of the outer lift is here shown provided with an extension or abutment piece R, with which the inner lift is capable of coming into contact after descent; and it is obvious than any one lift of a holder could be similarly provided—say, at interspaced intervals for supporting the lift within it, or, in some cases, the extension R (when itself suitably supported) could extend far enough to support more than one lift within the outer lift.

Gas-Lamps.

ANDERSON, D., of Farringdon Road, E.C.

Nos. 22,033 and 22,034; April 11, 1911.

This invention relates to gas-lamps and to devices for igniting and extinguishing gas-burners, both for heating (as in gas-stoves) and for lighting. The object is "to ensure that, at the moment of ignition, there is present in the neighbourhood of the burners to be ignited a mixture which is too rich in gas to cause an explosion such as would damage mantles or cause back-firing."



Anderson's Lamp-Lighter.

In the enclosed lamp, of the type illustrated, the gas supply is controlled by a cock near the top of the lamp; and the normal supply passes by the pipe B to the air and gas regulator C and the chamber D, from the lower side of which the burners are supported. The gas for flushing passes through the pipe E and joins the mixing-tube at F.

The ignition arrangements enable the lamp to be ignited by an ordinary lamplighter's torch—a pilot light being dispensed with. The pipe for supplying the igniting flame in this case is terminated in an exit piece formed with two jets, G H. The former projects a stream of gas in a lateral direction to a chamber I, in which there slides a plunger, having a rod J attached to it and flexibly connected over a pulley with one arm on a pivoted lever. The other jet projects a stream of gas vertically downwards to the neighbourhood of the burners. The lever carries a pawl K, adapted to engage with a projection on the cock so that it is prevented from rotating until the arm has been moved downwards by the upward movement of the plunger. The lever also carries a pin L, adapted to engage with the cock and turn it through a distance sufficient to turn on the flushing gas supply. The further movement of the cock is effected by engagement of one or other of the arms of the cock by means of the torch. It will, however, be seen that the cock cannot be turned to turn on gas unless the lever arm has been first operated, and that to turn on the normal gas supply and cut-off the flushing gas it is necessary to disengage the torch from the chamber I and engage an arm of the cock. The delay caused by this operation ensures that the normal gas supply shall not be turned on until the flushing gas has had time to make a very rich mixture in the neighbourhood of the burners. The ignition passes from the torch, through the tube and jet, to the burner, so that the arrival of the flame at the burner is impossible until sufficient flushing gas has passed—the pipes being designed to make it impossible for the flame to travel the distance required along the jets until sufficient gas for flushing has reached the burners.

The Chapel-en-le-Frith Rural District Council have decided to construct an additional reservoir at the Dovehole Water-Works, at an estimated cost of £4000.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Early Days of the British Association of Gas Managers.

SIR,—I have read Mr. Henry Woodall's letter in this week's "JOURNAL." May I suggest to him that his memory is at fault—not a surprising thing, considering the time that has elapsed since 1863, and in the absence of documentary evidence.

The list of those who attended the preliminary meeting, held at the Royal Hotel, Manchester, on Dec. 15, 1863 (as given in the "JOURNAL"), is correct. There were twenty-four gentlemen present. A letter, amongst others, was received from Mr. Woodall, regretting inability to attend, but testifying approbation of the objects of the meeting. Mr. Adamson, of Leeds, took the chair on the occasion. The meeting was not adjourned. All the business was transacted; and it was decided to hold the first general meeting of the Association on the 11th of May, 1864.

A list of members, along with the "Rules and Regulations," was issued (printed) in 1864. This is now before me. Mr. Henry Woodall's name is not included in the list.

The first general meeting of the Association was held on May 11, 1864, at the Mechanics' Hall, Manchester—Mr. A. Owst Atkinson, of Hull, occupying the chair. Thirty-eight gentlemen were present; but Mr. Henry Woodall's name does not appear in the printed list. After the preliminary business, the Chairman proposed that Mr. Thomas Hawksley, the distinguished Civil Engineer (who was present) should be elected President, and he consented; and by a further resolution Mr. Thomas Greaves Barlow, C.E., was elected Vice-President. The latter was not present. The first meeting he attended was in 1866, in London.

After an adjournment for dinner at the Royal Hotel, the sitting in the Mechanics' Hall was resumed—Mr. Hawksley occupying the chair as President. Three papers were read; and Dr. Letheby, assisted by Mr. William Sugg, delivered a lecture on "The Chemistry of Gas Lighting."

The second annual meeting was held at the Institution of Mechanical Engineers, Birmingham; and amongst the list of gentlemen elected members of the Association, Mr. Henry Woodall's name occurs for the first time.

I have thought it worth while to give these particulars for the sake of historical accuracy, though, but for Mr. Woodall's letter, I should have preferred to remain silent.

THOMAS NEWBIGGING.

Manchester, May 16, 1912.

The Recent Advance in the Price of Gas-Stoves.

SIR,—I have read with very mingled feelings your account of the reasons the gas-stove makers give for the recent advances; and, in my opinion, it would be much more convincing if it were not so obviously one-sided and extreme. Every point you state has reference to "cutting." I venture to say that only a small minority of gas undertakings force the makers to "cut" prices, and that no maker need cut unless he wishes to. I will take your points *seriatim*.

It is quite true that gas undertakings can, and do occasionally, modify their rates and conditions; but does it pay them to do so, unless it be to decrease the rates and increase the facilities? I know that an increase in price means less business; and, generally, I oppose all increases. So that while we have the power we do not use it, because it is not policy to do so.

Most gas undertakings hold exhibitions, and most gas undertakings bear a very large proportion of the cost, except that of canvassing. The makers are always the first to mention canvassing, and are generally aggrieved if it is not allowed. Canvassing, as a rule, is not to the permanent benefit of a gas undertaking, as, on the average, two-thirds of the apparatus so sent out will be returned to the stores within two months.

A stove maker will rarely buy-back old stoves, but he will offer, without being asked, 10s. for every old-type cooker, if one will buy new ones. Is this buying-back old stoves?

The Commercial Sections do not meet to raise prices, as do the "makers," but to discuss questions of policy and "*market*" prices. The makers are entitled to increased costs, but not permanently 15 and 20 per cent. on net. They may have to pay just now larger prices than 5 per cent. more for coal and iron. But these will not be maintained; and it is unfair to put another 5 and 10 per cent. after the 10 per cent. of two months ago just because of a panic. When the first 10 per cent. was put on, it was known that there would be trouble, and that, if there was, prices would be advanced.

Selling prices to the majority of gas undertakings are not lower than they were a few years since. Not long ago we had 33⅓ per cent. and 2½ per cent. discount from the present list price; then this was altered to about 31 per cent. net, then again to 30 per cent. net, and now finally to 19¼ and 15¼ per cent. net from the list. If the prices have, on special lines, been "acutely cut," the makers alone are responsible; and instead of making the majority of the gas undertakings pay for the losses occasioned by this cutting, why not revise the "cut prices," and leave the others alone to meet the 7½ per cent. or thereabout advance in prices of materials and the 5 per cent. advance in wages? The preparation of new patterns no doubt costs money, and has to be met; but when these costs are met by reduced costs in moulding by machinery, why saddle the gas industry with the increased costs, and not give them the benefit of the decreased expenses as well?

The "makers" can be divided into three classes—(1) The progressives; (2) the standstills; and (3) the reactionaries. (1) These pay 15 per cent. dividends and upwards, take up every new thing, and work it for all it is worth. They do not need an advance beyond the bare extra cost of materials and labour. (2) These watch the others, copy their patterns, and are generally one or two seasons behind; very often have inflated capital, and yet manage to pay 5 to 8 per cent. dividends.

(3) These firms are always behind, generally antiquated in their methods, will not bring out new designs, and think because they led the van once, they should always be treated preferentially. These pay little or no dividends, or only 2 or 3 per cent.

I can understand the latter wanting 15 to 20 per cent. increases, but not the former. Should all gas undertakings be called upon to subsidize the former in the latter class? Twenty per cent. on 20s.—that is, 4s.—seems small; but many medium-sized gas undertakings spend £2000 and £3000 per annum with the makers. This means an increase of £400 to £600, which will be a dead-loss to most, without any means of recovering, and may prevent a decrease in gas charges due to efficient manufacturing results, and make a manager's efforts of no avail.

Twopence or less per pound. This is extreme indeed. Fourpence and fivepence per pound for first-grade cookers is the usual price, and the one mentioned, which means about 28s. for a cooker, is for the smallest slot cooker generally fixed, which I and many others have had offered, and been pressed to take, and have refused over and over again, because of its cheapness. Good consumers will have the best article, not these cheap "cut" articles.

As to large stocks, can a manager foresee his requirements and the vagaries of the weather? and was the argument as to large stocks permissible during the past two or three seasons, when everybody save the Gaslight and Coke Company and Manchester had to wait weeks for the completion of orders because the makers had no stocks?

As regards the cost of effecting efficiency, certain firms have expended large sums of money in experimenting to their own advantage—viz., 15 per cent. dividends. But has not the gas industry spent something, too? I rather think I have seen, in the "Transactions" of the Institution of Gas Engineers, something about gas-fire experiments at Leeds. We do not say "Thank you for nothing," nor do we wish to depress prices. We say 15 and 20 per cent. increases cannot be justified; and until they are, we shall continue to say so.

Unfair one-sided contracts I do not know anything about. I know I have not made any. What I am concerned about is that my undertaking is not damaged by having to pay for the sins of others.

I have nothing further to add, except that I hope these criticisms of your article may bring to light facts which are very obscure; and if the facts prove that 15 and 20 per cent. advances are necessary, then we will pay them without murmuring, but not until then.

Stretford, May 16, 1912. H. KENDRICK.

[Our correspondent well examines the question from his own point of view; but we do not see anything in the letter that disestablishes the concrete facts shown by the cost-books of the gas-stove manufacturers. Those facts are based upon something more tangible and lasting than a transient "panic." Mr. Kendrick hopes that his criticisms "may bring to light facts which are very obscure;" and he adds that "if the facts prove that 15 and 20 per cent. advances are necessary, then we will pay them without murmuring, but not till then." This being so, it may be inferred that Mr. Kendrick is not quite sure of the premisses from which he has made his deductions. However, in view of the quoted statement, it would be altogether unprofitable to beat the wind by discussing our correspondent's letter, as the gas-stove makers—Mr. Kendrick appears to have overlooked this—have shown their assurance in the justness of their attitude, by offering to place (in confidence) before a Joint Committee, composed of leading members of the Institution of Gas Engineers and an equal number of the members of their own section of the manufacturing industry, full particulars in justification of their action. That is a very fair offer. No one can expect them to publish broadcast their works and other costs; no one, we should imagine, would have the effrontery to ask for it. Sufficient should it be for those who are perturbed by the recent action to accept the verdict of a Joint Committee who have seen and examined the evidence.—ED. J.G.L.]

Statements in Companies' Prospectuses.

SIR,—I notice in your issue of the 14th inst., a prospectus of the Regenerative Gas-Stove Company, preceding which is a statement giving the list of gas companies and other establishments to whom the Harris patent gas apparatus has been supplied. Among the gas companies they mention the South Suburban Gas Company.

It would seem from this that considerable business had been done in these appliances; but if the business done with us is a sample of the rest, the statement is calculated to mislead the investing public. All the business we have done with the Harris patent gas-griller is to supply one of the grillers to the order of a customer in our district in November, 1908.

Your readers will be able to draw their own conclusions.

Lower Sydenham, May 15, 1912. SYDNEY Y. SHOUBRIDGE.

Electricity Generation by Gas-Works.

SIR,—In the paragraph headed "Electricity Supply by Gas Companies" in your issue of the 14th inst., dealing with the Bognor Gas Company's Bill, you say: "Mr. Dykes made an interesting statement in the course of his evidence, to the effect that, in the case of electricity generating stations with which he is associated and which use oil-engines, their cost is 0·29d. per unit, as against 0·14d. for a gas company using their own gas and coke."

I fear the reporter has, unfortunately, confused two sets of figures. I gave the cost of fuel per unit sold by the Leatherhead Electricity Company, who use Diesel oil-engines, as 0·29d. per unit. Later on, when comparing the estimated running costs of Mr. Tate's station with that of the proposed station of the Bognor Gas Company, I pointed out that—assuming a consumption of 0·68 lb. of oil per unit generated and oil at 50s. per ton—the cost per unit generated would be 0·182d., whereas to the Gas Company, using gas-engines and producer gas generated from their own coke (for which they charged themselves 13s. 4d. per ton), the cost per unit generated, at 2 lbs. of coke to the unit (the figure guaranteed by the makers of the Ascot Electricity Company's engines), would be 0·14d. So that the Gas Company would be able to generate more cheaply with their gas-engines than Mr. Tate could do with his Diesels.

The last two figures represent the cost per unit generated at full load, and are, of course, very different from the cost per unit sold, which includes all losses due to transmission, units not metered, reduced efficiency when running on light load, and similar losses.

Apart from any question of fuel costs, however, there can be no question that in small towns there is undoubted economy in combining the supply of gas and electricity in one undertaking; and the result of my experience as adviser to the Ascot, Farnham, and other combined gas and electricity undertakings, convinces me that within the next few years a large number of the smaller towns will be served in this way.

11, *Victoria Street, S.W., May* 17, 1912. A. H. DYKES.

Automatic Lighting of Street-Lamps.

SIR,—Automatic lighting at Princes Risborough, with the "Gunfire" controllers, has proved an unqualified success; the lighting authorities there being delighted with the precision and accuracy of these controllers.

Recently I was staying at Bournemouth, and took the opportunity of visiting the Automatic Light-Controlling Company's works, where this apparatus is mainly manufactured. I was certainly surprised, not only to see the extent of their output, but the machinery they had installed, and the very up-to-date manner in which this business was being dealt with. I gathered from the Managing-Director that the present year was proving the most successful they had had since the formation of the Company; and I have just received from him a balance-sheet which justifies this view.

I have no interest whatever in the Company, but I happen to be one of the very first to whom samples of the apparatus were submitted; and, having spoken highly of it in those early days, before it had proved such a success, I have pleasure in being able to substantiate my then expressed opinion, and am glad to note that the controllers have been adopted at such places as Liverpool and Newcastle-on-Tyne, both of which, I understand, have been supplied with large numbers during the present year, in addition to Oxford, Exeter, Portsmouth, &c.

GEORGE LANE,
May 13, 1912. Engineer, Princes Risborough Gas Company, Ltd.

Preventing Waste of Heat from Gas Cooking-Stoves.

SIR,—Referring to Mr. Harris's illustration of his arrangement for preventing waste of heat from gas cooking-stoves, in the "JOURNAL" for the 7th inst. (p. 378), I may mention that I made an oven very similar to his eight or nine years ago, and at a very small cost. It answered the purpose for which it was intended—viz., for utilizing waste heat; and that satisfied me.

Birmingham, May 14, 1912. G. B. DENSTON.

The Evidence on the Woking Gas Bill: A Correction.—In the report of the opening of the proceedings on the Woking Gas Bill on the 8th inst., as given in the "JOURNAL" last week (p. 454), Mr. E. L. Burton, who was called to prove the preamble, was inadvertently referred to as the Secretary of the Company. This position is filled by Mr. B. Dennett Holroyd, F.C.A. (who is also Secretary of the Woking Water Company); and he was in attendance throughout the proceedings, ready to give material evidence in support of the Bill had the opposition to the preamble not collapsed.

Fleetwood Gas-Works Purchase Question.—A public meeting was held last Tuesday at Fleetwood for the purpose of ascertaining the opinion of the ratepayers on the question of the Council purchasing, on fair and equitable terms, the undertaking of the Fleetwood Gas Company. Mr. W. C. Frith (the Chairman of the Council), who presided, said they desired to ask the ratepayers to support the Council in the principle that the gas undertaking should be in the hands of the local authority. Mr. Swarbrick moved that the meeting approve of the action of the Council in opposing the Gas Bill, and urge them to continue their opposition with a view to acquiring the undertaking. Dr. Preston, in moving as an amendment that the ratepayers do not support the Council in the proposal to purchase, complained that the Council had gone to the House of Commons without the consent of the ratepayers. They had already spent £400 in opposing the Bill, and had lost the case on all points; and now they wanted to go to the House of Lords. Eventually the original resolution was carried by a large majority.

Price of Gas at Southport.—At a meeting of the Southport Town Council last Tuesday, Mr. Trounson, in moving the adoption of the minutes of the Gas Committee, expressed regret at the inability of the Committee to recommend a reduction in the price of gas. He admitted that gas consumers were paying too much towards the relief of the rates, as they paid £2 1s. 6d. in every £10, whereas the electricity consumers only paid a little more than 8s. To reduce the price of gas by 1d. per 1000 cubic feet would mean a loss of nearly £2000 a year. The Gas Committee were already committed to the payment of £13,000 in relief of the rates this year; and they had also undertaken to pay out of the profits a further sum of £4500 to wipe out the suspense account; so it was obvious they could not afford another £1600 by reducing the price of gas for the remainder of the present year. He promised that the matter should be brought to the attention of the General Purposes Committee before the end of the financial year. Mr. Snow remarked that the payment of £13,000 by the Gas Committee in order to keep down the rates was an inducement to rich people to live in the town; and the money came out of the poor residents who were gas consumers. It was a question of robbing poor Peter to pay rich Paul.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills :—

Bills read the first time and referred to the Examiners: Fylde Water Board Bill, Ivybridge Urban District Water Bill, Kilmarnock Gas Provisional Order Bill.

Bills read a second time and committed: Ashborne Urban District Council (Gas) Bill, Belfast Water Bill, Birmingham Corporation Bill, Tavistock Urban District Council Bill.

Bills reported: Houghton-le-Spring District Gas Bill, Wakefield Gas Bill, Woking District Gas Bill, York United Gas Bill.

Bills read the third time and passed: Brighton and Hove General Gas Company Bill, Church Stretton Urban District Water Bill, Christchurch Gas Bill, Derwent Valley Water Bill, Dunstable Gas and Water Bill, Herne Bay Gas Bill, Llanelly Rural District Water Bill, Swanage Gas and Water Bill, Wandsworth, Wimbledon, and Epsom District Gas Bill, York United Gas Bill.

The Alkali Manufacturers' Association have presented a petition against the Ashborne Urban District Council (Gas) Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills :—

Bills brought from the Lords, read the first time, and referred to the Examiners: Brighton and Hove General Gas Company Bill, Christchurch Gas Bill, Derwent Valley Water Bill, Herne Bay Gas Bill, Llanelly Rural District Water Bill, Swanage Gas and Water Bill, Wandsworth, Wimbledon, and Epsom District Gas Bill, York United Gas Bill.

Bills reported: Gas and Water Provisional Orders Bill [Orders confirmed], Glasgow Corporation Water Bill, Glasgow Water (Charges) Bill [preamble not proved].

Bills read the third time and passed: Bognor Gaslight and Coke Company (Electricity) Bill, Dover Corporation Bill, Fylde Water Board Bill, Kilmarnock Gas Provisional Order Bill, Sidmouth Urban District Council Bill.

Standard of Lighting for Factories.

Last Thursday, Mr. Lynch, the Member for West Clare, asked the Home Secretary whether his attention had been called to the fact that in the report of the Departmental Committee on Accidents, 1911, the necessity is indicated of fixing standards for lighting; and whether he could state what steps, if any, he proposed to take to carry this recommendation into effect. In a second question, he pointed out that in the chief Continental countries the whole subject of illuminants is receiving attention; that France has appointed a Special Committee to study it exhaustively, and with especial regard to the lighting of factories, mines, and public buildings; that in Belgium a congress has devoted much consideration to the matter; that Holland has established a minimum standard for lighting factories; and that at the International Electrical Congress of Turin last year it was decided to proceed to the formation of an International Lighting Committee. He asked whether, in view of the greater interests of this country involved in the question, steps would be taken to co-operate in this movement, and a Special Commission on the subject be appointed.

Mr. M'Kenna said the subject had been under the consideration of his department for some time past, with reference both to the recommendation of the Accidents Committee and also to the work now being done on the Continent in the matter; and preliminary investigations had already been made. The questions involved were very complex and technical; and he proposed in the near future to appoint a Departmental Committee of an expert character to report on the subject.

The passage in the report referred to by the hon. member is as follows: "The question of the requirement of adequate lighting is difficult, because of the absence at present of any recognized standard. The Committee . . . recommend that investigation be pressed on as much as possible, with a view to the early adoption of a practical standard. In the absence of a standard, definite regulations, such as exist in certain foreign countries, would lead to considerable difficulties in administration; but even before a standard can be arrived at, we recommend that the inspectors should be given general statutory powers to require adequate lighting in all places where work is done, and in all places which are a source of danger by reason of insufficient lighting."

Tarred Roads and Fish Destruction.

In accordance with notice, Major Baring asked the President of the Board of Agriculture whether his attention had been drawn to the wholesale destruction of fish in the neighbourhood of Rickmansworth, attributed to the pollution of the water by tar from the roads; whether he was aware that numerous similar instances had been reported from other parts of the country; and whether any investigation was being made by his department.

Mr. Runciman replied that his attention had been drawn to the matter, but said it had not been definitely settled that the destruction of the fish was due to the cause mentioned. The Board were inquiring into this particular case, and seeking information on the subject generally.

Gas-Works for Margam.—At their meeting on Monday last week, the Margam Urban District Council unanimously adopted the scheme prepared by Mr. Frank H. Jones, M.Inst.C.E., for gas-works for the supply of the district; and the Clerk was instructed to take steps to raise the sum of £55,000 required for the undertaking, and proceed at once with the acquisition of the site.

THE CHEMICAL CLAUSE AND THE UNOPPOSED BILLS COMMITTEE.

Clause Not Inserted in Swansea and West Kent Orders.

SWANSEA PROVISIONAL ORDER.

Last Tuesday, the Committee of the House of Commons on Unopposed Bills met, under the Presidency of Mr. WHITLEY, to consider the Bill to confirm Provisional Orders with regard to the Hatfield, Swansea, and West Kent Companies.

Mr. BONNOR-MAURICE, who represented the Board of Trade, stated on their behalf that these Orders were of the usual form, and that the only question that he had to speak upon was with regard to the residual products clause, which was this session being added to all Bills. He understood there was a suggestion that the words "by them" should be inserted in the clause, so as to restrict the dealing of the Company to residuals arising from the manufacture of gas by them.

The CHAIRMAN said the position briefly was that they had been asked to restrict gas companies to dealing with their own residuals. The words "by them" were inserted in a Bill which was recently before the Committee; and he stated then that he should not insert them if the promoters objected. They did not object in that case; so that this Committee had not yet laid down any policy on the matter. If, however, he understood the views of the Committee, they were that statutory companies created for a particular purpose ought not to go beyond that purpose except on evidence presented to the Committee, and that the Committee were willing to hear the case of each Company on its merits.

Mr. COOPER, on behalf of the Swansea Gas Company, stated, with regard to their Order, that he understood the ruling of the Committee was that they would not take away the power now possessed under previous Acts by any company who had been in the habit of using that power, if they could satisfy the Committee that the taking away of the power would prejudice the interests of the locality affected. He therefore proposed to do so in the case of Swansea. The Swansea Gas Company had power "to manufacture, purchase, and deal in residual products;" and he was informed that the Company had for some time had business relations with a number of small companies in the neighbourhood, for the purchase of ammoniacal liquor, which they worked-up with their own ammoniacal liquor and produced sulphate of ammonia. It was a mutual benefit to the purchasing company and to the selling company. The selling company would be placed in an awkward position if they had not the power, because they worked on so small a scale that they were not able to produce a sufficient quantity to make it worth while to send it to the nearest alkali or chemical dealer. The cost of carriage would swallow up whatever price the chemical manufacturers could offer. He further stated that the Swansea Gas Company rendered smaller companies in the neighbourhood help, when they found that they had stored a large quantity of liquor, and were not able to dispose of it.

Mr. *George Andrews*, Engineer and Manager of the Swansea Gas Company, was then called by the Chairman, and stated that it was found convenient and economical to work-up the ammoniacal liquor purchased from the small neighbouring companies with their residual products. Around Swansea, as in other places in South Wales, there were numerous small companies who had a make of from 3 to 5 million cubic feet per annum, and consequently only made a small quantity of ammoniacal liquor and tar, which they could not always dispose of to advantage. Often in the case of these small works the tanks that they had to store the ammoniacal liquor in were not of very large capacity. They had therefore to cask the ammoniacal liquor, or get rid of it the best way they could. The distance from these works to the nearest station where alkali manufacturers carried on their business was too great for it to be sent by rail. The price of the liquor ranged from 8s. to 10s. per ton; and the railway rate on this would amount to quite that sum, if they had to forward it to Runcorn or Liverpool, or any other alkali or chemical manufacturers' district. It often meant, to the smaller company, a profit or loss, whether they were able or not to find a ready sale for their products.

The CHAIRMAN asked whether Mr. Andrews could give the Committee further information about other cases similar to Swansea.

Witness replied that he had not come prepared with any evidence; but as the Committee had mentioned Cardiff, he might say that it was only lately that the Cardiff Gas Company had installed a sulphate plant. Previous to this, they sold their liquor to be made up into sulphate elsewhere.

Mr. MOON, K.C. (the Speaker's Counsel), inquired whether any small companies made ammonia out of ammoniacal liquor.

Witness replied that he was not aware at the present time of any small companies around Swansea making ammonia from ammoniacal liquor. There might be one in the Merthyr district.

The CHAIRMAN asked what was the size of a gas undertaking when it became worth while to treat its own residuals.

Witness: I should think anything between 25 and 50 million cubic feet per annum.

The CHAIRMAN next inquired what induced both companies and municipalities to go in for further development of their residuals, and asked whether it was only a recent development.

Witness: In Swansea, sulphate of ammonia has been manufactured since 1870 or 1871.

The CHAIRMAN: Probably the distance from other markets induced you to do that at such an early date.

Witness: I do not know whether that is the exact reason; but we did work-up liquor then, and also purchased from the surrounding gas-works, who could not sell their ammoniacal liquor elsewhere.

Mr. MOON: The use of sulphate of ammonia is a comparatively recent industry?

Witness: I cannot say that it is recent. I have known it all my life. It is used as a manure in sugar beet growing; and recently it has come

more into favour, and is employed in England by farmers and others for agricultural purposes.

After some further remarks, the room was cleared, so as to allow the Committee to deliberate in private. On the re-admission of the parties,

The CHAIRMAN said: In the case of the Swansea Gas Order, the Committee are satisfied that there should be power to purchase and work-up residuals other than their own, and that the chemical clause should not be added to the Swansea Gas Order. With regard to the general question, the view that the Committee take is that, where a company or authority desire power to work-up residuals other than their own, evidence should be offered to justify such a proposal; and, therefore, the Committee think that the other two Companies concerned in this Order should have some opportunity of offering evidence to the Committee. They propose to adjourn the further consideration of this Bill until Thursday, in order that such an opportunity may be afforded to the other two Companies named in the Bill.

WEST KENT PROVISIONAL ORDER.

The Unopposed Bills Committee of the House of Commons, presided over by Mr. WHITLEY, considered the West Kent Gas Provisional Order on Thursday.

The main provision of the Order is to empower the West Kent Gas Company to construct further works upon additional lands; and discussion took place upon clause 6, which reads as follows:

> The undertakers may, on the lands shown on the map deposited for the purposes of this Order, and described in the schedule to this Order annexed, while they are possessed of the same, construct, erect, maintain, extend, and enlarge gasholders, apparatus, and works for the manufacture and storing of gas and matters producible therefrom, and they may, subject to the provisions of this Order, upon the said lands, manufacture and store gas and supply and sell the same within the limits in which they are authorized to supply gas, and they may manufacture, sell, provide, supply, and deal in coke, tar, and all other residual products or refuse of any materials employed in, or resulting from, the manufacture of gas, and they may construct and maintain and alter, enlarge, and renew, or discontinue, houses, offices, buildings, and other works connected with the undertaking.

In respect of this clause, it had been proposed to insert the words "by them" after the word "gas" in the fourth line from the end; and this was resisted by the promoters.

Mr. E. CAMPBELL COOPER (R. W. Cooper and Sons, Parliamentary Agents), for the West Kent Gas Company, pointed out to the Committee that the Company were in a special position, having very wide powers, both as to manufacturing and dealing in ammoniacal liquor and other products resulting from the manufacture of gas. They were now under new and more energetic management. The district was rapidly growing, and under this Order powers were taken to manufacture gas on a site adjoining the river. The Company had not hitherto exercised the wide powers which Parliament had already given them with reference to residual products, because they had not reached a sufficiently large scale to justify putting down the necessary sulphate plant. Now, however, the Directors thought that this period had been reached, and that they were on the eve of great developments. Therefore they contemplated putting down a sulphate plant. There were in the vicinity a number of small gas companies on both sides of the river, with whom the Company would be able to deal; and therefore they were placed in an exceptionally favourable position for exercising their existing powers. The Committee could readily realize that they did not desire to put down plant which would not be fully occupied, or at any rate largely occupied, in order to avoid having too much capital lying idle. The Company felt that, by the exercise of their existing powers, they could now profitably instal a sulphate plant, both in the interests of the consumers and of the neighbouring companies. Therefore, it was to the public interest that the Committee should not put restrictions upon the Company's existing powers as to dealing in ammoniacal liquor. He had communicated with practically all the gas companies in the United Kingdom.

Mr. MOON (the Speaker's Counsel), interrupting, said he did not think these communications had anything to do with the case.

Mr. COOPER said he wished to show, by the answers he had had from these companies, what was the practice of the chemical industry, and what the result had been.

Mr. MOON said the Committee could not go into that.

Mr. COOPER said he did not rely upon this as evidence; but he put it as a matter of argument that the result of this restriction would be to force the small companies——

Mr. MOON, again interrupting, said this was the general question.

The CHAIRMAN: You have your manager here?

Mr. COOPER: Yes. I will call him, and put some questions to him to bear out what I have said.

This Order empowers you to take additional lands?—Yes.

And it is on these lands in future that you propose to deal with these residual products?—We hope to.

And you ask the Committee not to put any limitation on the use of these lands which does not now apply to your original works?—I do.

Mr. *B. R. Green*, the Consulting Engineer to the West Kent Gas Company, was then called. He referred to the existing wide powers of the Company to deal with residual products, but which had not hitherto been exercised. The Company, however, were about to considerably enlarge their operations, and contemplated laying down a sulphate plant. There were a number of gas companies in the district from whom the West Kent Company could purchase ammoniacal liquor, both in Kent and on the other side of the river. These all disposed of their ammoniacal liquor at the present time, although one company had a larger output than that of the West Kent Company. The reason for this was the lack of space on which to erect sulphate plant. Undoubtedly the West Kent Company could manufacture their own sulphuric acid at a lower price than they could purchase it. The present output of the Company was 75 million cubic feet per annum; but this was about to be largely increased, because, during the past six months, they had been installing a large number of slot meters. Last year there was an increased consumption of 33⅓ per cent. The Company's works were situated in an ideal position on the river at Erith. The Company served Erith, Bexley, Bexley Heath, and part of Abbey Wood and Belvedere; the total area being 15 to 20 square miles.

Mr. COOPER pointed out that the South Suburban Gas Bill, which had already passed the House of Lords, took powers to absorb the West Kent Company; so that, in the event of that Bill finally passing into law, it would be immaterial what restrictions were placed upon the West Kent Company, because it would then be worked under the powers of the South Suburban Act. The amendment now proposed would only be of importance in the event of anything happening to the South Suburban Bill.

The CHAIRMAN said he was aware of this, but thought the Committee should treat the present case on its merits, and on the assumption that the South Suburban Bill did not pass.

In answer to questions by the CHAIRMAN,

Witness said he believed the neighbouring companies at present sold their ammoniacal liquor to chemical manufacturers; but he could not say to what district it went. He had heard that the whole of the country was mapped out into areas by the chemical manufacturers, and that the policy was to assign particular areas to particular manufacturers so far as the supply of ammoniacal liquor was concerned. He was not prepared to say the price which prevailed in his district for ammoniacal liquor; but it was a very low one, compared with the North of England, and even the Midlands. It was difficult to dispose of residuals in the neighbourhood of London at a reasonable price; but if the West Kent Company could work a sulphate plant, the neighbouring companies would get a freer market for their liquor. No offers had yet been made to the neighbouring companies. As a business proposition, however, he could offer them better terms than they were now getting.

Mr. MOON: We are told that it would pay to put up a sulphate plant with an output of from 30 to 50 million cubic feet.

Witness: I should say that was on the small side.

Is it the smallness of your output or insufficiency of land that has prevented you from putting up sulphate plant hitherto?—Both. There was not at one time any prospect of development; but the conditions have now altered.

And I take it that, having regard to the development you expect, you would put up a plant whether you had power to buy from other sources or not?—Probably we should.

How do you dispose of your ammoniacal liquor now?—It is sold at present.

Is there any business reason for not telling us the name of the firm?—No. It is Messrs. Bowker and King.

Who are they?—They are brokers. I do not know where the liquor goes to.

What are the names of the companies you have in mind from whom you would buy?—There is the Dartford Company, with an output of 140 to 150 millions. This is the Company who have not enough land. There is also the Northfleet Company, with 40 millions output.

Do they sell now to the Gaslight and Coke Company, or how do they get their market?—I do not think they sell to that Company. Then there is the Grays Company, on the other side of the river; and the Mid Kent Company might also sell to us.

What about the Maidstone Company?—That has a larger output than ours. Whether they buy or not now, I do not know.

The room was then cleared. When the parties were readmitted,

The CHAIRMAN said: In the West Kent Gas Order we do not propose to insert the words.

No restriction is thus placed upon the Company.

FURTHER INSERTIONS OF THE CHEMICAL CLAUSE.

The chemical clause was inserted during the week in the following Bills and Order:

BORDON AND DISTRICT GAS BILL.

This Bill provides for the dissolution of the East Hants Gas Company, Limited, and the incorporation of the Bordon and District Gas Company as a statutory undertaking. The capital of the East Hants Company was £30,000, in £10 shares; but the capital of the new Company is to be £40,000, of which £28,310 represents the issued capital of the East Hants Company and the remainder new capital under the Bill, and which may be raised either as ordinary or preference shares. Borrowing powers to the extent of one-third are also given under the Bill. All the new capital is to be raised under the auction clauses. The standard price is fixed at 5s., and the illuminating power at 14 candles.

Clause 7 reads as follows, having been slightly amended from the original draft:

> The Company shall be established for the purpose of acquiring, maintaining, altering, improving, extending, enlarging, removing, or discontinuing the gas-works of the limited company, and of erecting gas-works, manufacturing and supplying gas for lighting, heating, motive power, and other purposes within the limits of supply, and may convert, manufacture, and sell all residual products resulting from the manufacture of gas by them, and generally may carry on the business usually carried on by a gas company.

The following new clause has also been added:

> The Company shall not purchase or use in any process of manufacture any materials other than those required for the making and supply of gas by them, or for the working-up of their own residual products, or for the construction, maintenance, and repair of their gas-works plant and buildings or of gas-fittings.

With these amendments, the Bill was ordered to be reported for third reading.

HOUGHTON-LE-SPRING DISTRICT GAS BILL.

This Bill extends the limits of supply of the Houghton-le-Spring District Gas Company, which was incorporated in 1879, and also authorizes the raising of additional capital to the extent of £30,000 as ordinary or preference shares with one-third borrowing powers. This new stock is to be sold under the auction clauses. The Bill also re-arranges the price of gas—fixing it at 4s. per 1000 cubic feet in Houghton-le-Spring and 4s. 6d. in the outside districts. The candle power is now to be 14, and the testing burner the "Metropolitan" argand No. 2.

Since the Bill was deposited, the following clause has been added:

> Notwithstanding anything contained in the Act of 1879, the Company shall not purchase or use in any process of manufacture any materials other than those required for the making and supply of gas by them or for the working-up of their own residual products, or for the construction, maintenance, and repair of their gas-works plant and buildings, or for the maintenance or repair of gas-fittings.

In this form, the Bill was ordered to be reported for third reading.

HATFIELD GAS ORDER.

During the proceedings on the West Kent Order, it was stated that the Hatfield (Yorks) Gas Company had agreed to the amendment being inserted in their Order. In this case, the Company take power to raise £5840 additional capital, to purchase lands, supply fittings, &c. The price is fixed at 5s. per 1000 cubic feet, with power to the Board of Trade to modify after three years. The illuminating power is 14 candles; the testing burner being the "Metropolitan" argand No. 2.

LEGAL INTELLIGENCE.

ALLEGED POLLUTION OF WATER BY GAS-WORKS.

In the Chancery Division of the High Court of Justice last Friday, before Mr. Justice Swinfen Eady, the case of the *Colne Valley Water Company v. Watford Gas Company*, which had been before him on a previous occasion [see *ante*, p. 455], was mentioned.

Mr. UPJOHN, K.C., said the plaintiffs asked for an injunction to restrain the defendants from permitting water impregnated with gas to percolate into their works. It had been discovered that a gasholder tank had a large crack in it through which leakage was occurring.* At the previous hearing Mr. Russell, who appeared for the Gas Company, stated that they were pumping the water out of the tank, and would continue doing so with all reasonable dispatch. The evidence filed on behalf of the defendants showed that they had emptied the tank, and were removing some sediment from the bottom; and they proposed to clean out the tank. In the course of these operations, a large crack had been located. The defendants, who had been quite frank in stating the facts about the fracture of the tank, raised this case—that the crack was caused by a settlement of the side of the tank caused by plaintiffs' pumping a few hundred yards away; and he suggested an early trial. If the case could be disposed of before the Long Vacation, he hoped defendants would not use the tank in the meanwhile, and that the plaintiffs would have inspection by their Engineers and assistants, with liberty to take measurements to find out where the leakage came from, and whether the subsidence was due to the plaintiffs' pumping.

His LORDSHIP asked whether there was any dispute as to where the leakage came from.

Mr. RUSSELL said he was not prepared to make any admission at present.

Mr. UPJOHN said his evidence was that the water came from the defendants' works; but to ascertain the exact facts a much longer examination would be necessary.

Mr. RUSSELL said he was willing to give full and complete inspection. The water in the tank was originally pure water, not gas liquor. He was willing to consent to an early trial, and would undertake not to refill the tank until the crack had been repaired. The repairs would take some time; but they would not be commenced until inspection had been made.

After some discussion it was arranged that the statement of claim should be delivered by the first day of next sittings, the defence ten days afterwards, and the reply within seven days, mutual discovery at once, with liberty to apply to fix a day for the trial. On this understanding, no order was made on the motion, except that the costs should be costs in the action.

WATER SUPPLY TO SEPARATE HOUSES.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, May 10.

(*Before the* LORD CHIEF JUSTICE, *Mr. Justice* PICKFORD, *and Mr. Justice* AVORY.)

South-West Suburban Water Company v. Hardy.

This was an appeal by the Company from a conviction for an offence against the Water-Works Clauses Act, by refusing to furnish a supply of water to seven houses in Featherstone Road, Southall, belonging to the respondent.

Mr. MACMORRAN, K.C., and Mr. JOSEPH appeared for the appellants; Mr. GERARD HILL represented the respondent.

Mr. MACMORRAN said the respondent was the owner of the houses in question, which had hitherto been supplied with water by one service-pipe. As they were of the annual value of more than £10, the owner was not bound to pay the water-rate; but as it was not paid by either owner or tenant, the Company cut off the water, whereupon the owner sent a cheque for the amount, and demanded that the supply should be restored. The Company refused to reconnect unless a service-pipe was provided for each house; and on the owner taking proceedings against them, the Justices convicted, but stated a special case for the opinion of the High Court. The case set forth that the value of the houses was £11 10s. each. In January, 1911, the respondent was in arrear in respect of the water-rate payable on the houses; the usual demand notes were served as the rates fell due; and final applications were sent on Jan. 28 and June 10 respectively. On March 14 the Secretary of the Company wrote to the respondent giving him notice that payment of the rates in arrear would be enforced against the tenants of the houses; and on March 23 the appellants' collector served notice upon them. It was not proved that the respondent knew of these demands. The water was cut off on the 1st of September; and on the 16th, the respondent sent to the appellants £10 10s. 2d., the amount of the arrears due on the 24th of June in respect of the houses. On the same day the respondent requested the appellants to reconnect the supply; and they expressed their willingness to do it as soon as a separate service-pipe was laid to each house. On Sept. 21, the respondent sent a cheque for £3 4s.—being half-year's payment for water in advance; and on the 30th the cheque was returned. The appellants submitted that the respondent was not a person entitled under the Acts and Orders to receive a supply of water during the time for which the rates should have been paid or tendered, and that in refusing the supply they were acting lawfully. The respondent contended to the contrary, and submitted that he ought not to be put in the position of a new customer. Counsel having called attention to the express provision in the Act which enabled the occupier of any house to demand a separate service-pipe, cited the case of *Sheffield Water Company v. Wilkinson** as proving that the respondent was not a person entitled to receive a supply at all. The severance of the connection, assuming it to have been lawful, put the respondent in the position of taking a new supply; and the Company were entitled to say that he must have a separate supply to each house. His short points were that so long as the communication remained severed the respondent was not a person entitled to demand a supply; and that, even if he were, he could not insist on a supply through one pipe common to a number of houses.

Mr. GERARD HILL contended that the Justices had come to a proper decision. The case was fought before them entirely upon the ground that the Company had a right to demand a separate pipe to each house. In the Sheffield case cited, it was admitted that the connection had been lawfully severed by the Company; but here it had been unlawfully done, as the proper remedy was by applying for a charge on the property of the owner.

Justice AVORY asked why the owner was liable for the water-rate.

Mr. HILL replied that it was a matter of agreement, he having under it paid the rate for more than eighteen years.

The LORD CHIEF JUSTICE observed that in the special case nothing was said about an agreement. The case must be argued on the basis that the water was properly cut off, and that the owner had a right to have it restored through the old pipe.

Mr. HILL contended that the cutting-off was unlawful, and that therefore the Company could not pray in aid their own wrong. He asked that the case should go back to the Magistrate to find whether or not there was an agreement that the owner should pay the rate. If there was, the case of the *Sheffield Water Company v. Brooks*† was a distinct authority that the respondent had taken the proper course. Even as the special case now stood, there was sufficient to show that there was a finding that the owner was liable to pay the rate.

The LORD CHIEF JUSTICE: Why was the cutting-off unlawful?

Mr. HILL: Because it was contrary to the express provisions of section 4. Here the owner, and not the tenant, was liable for the water-rate; and section 4 provided that in such a case the Company could not cut off the water for non-payment of the rate.

The LORD CHIEF JUSTICE: The case finds that the cutting-off was lawful.

After conferring,

The LORD CHIEF JUSTICE said there was a statement in the case on which the Court had no difficulty; but Mr. Hill had, with great ingenuity, raised the point that upon the case he was entitled to argue that the cutting-off was unlawful. The case would go back, at the respondent's peril as to costs, for the Justices to find whether, under the circumstances, the cutting-off was lawful or not.

Mr. HILL asked for time to consider the matter.

It was decided that if the respondent did not desire that the case should go back, judgment would be delivered the following Wednesday morning.

Wednesday, May 15.

On the resumption of the hearing,

Mr. HILL said the respondent desired that the case should go back to the Justices for a further finding of fact as to the circumstances under which water was supplied to the seven houses.

The LORD CHIEF JUSTICE said the case would go back for a finding of fact as to the cutting-off, and as to whether or not it was lawful.

* It was stated on the previous occasion that liquor was escaping from a liquor tank, whereas, as now shown, it was water from a gasholder tank which had developed a leak.—ED. J.G.L.

* See "JOURNAL," Vol. XXXIII., p. 435.

† *Ibid.*, Vol. XXXIX., pp. 572, 652.

Northampton Water Supply.—A Local Government Board inquiry was held by Mr. M. K. North at Northampton last week, with reference to an application by the Town Council for sanction to borrow £2000 for the extension of the water-mains. The Town Clerk (Mr. H. Hankinson) pointed out that the average annual expenditure on water-mains during the past five years had been about £330; but he added that it was difficult to estimate the exact length of time over which the sum now asked for would be expended.

MISCELLANEOUS NEWS.

NOTTINGHAM CORPORATION GAS UNDERTAKING.

[From Our Nottingham Correspondent.]

Gas Profits and Rate Relief.

Attention has been more than once directed in the "Journal" to the instructive lesson afforded by Nottingham's experience in relation to the application, in relief of municipal burdens, of profits made out of the Corporation gas undertaking. The matter derives added significance from reports regarding the matter which have been presented within the last few days. Faced with the contingency of an increased district rate, the Conservative majority in the Council determined to keep the impost down to last year's level of 6s. 5d. in the pound; but this could only be effected by a largely augmented demand upon the profits of gas supply—the proposal leading to some trenchant criticism, at last Thursday's meeting of the Council, by the opposition, whose condemnation was based upon the allegation of unsound finance. As will be seen by the report of the proceedings, it was only by the casting vote of the Mayor that the project was passed; the preliminary meetings convened for the consideration of the Finance Committee's report having had as their sequel the resignation of several Liberal members in protest against the manner in which the business was carried through. The main fact is that but for the substantial assistance obtainable from the gas revenue, *plus* proportionate contributions from the two other large trading concerns, Nottingham finance would be in a very parlous state. By the aid of the profits derived from gas, tramways, and electricity, it has been determined to keep the district rate down to last year's point. But on Thursday, when the subject was debated in the Council for more than three hours, the protest forthcoming as to the means employed to achieve the end was especially keen as to the undue "raid" upon the gas revenue. But for the profits derived from the gas undertaking, the Nottingham rates must have been increased by 8d. or 9d. in the pound, to say nothing of a further large addition which would have been necessitated if contributions from the other two departments represented by the tramways and electricity supply had not also been available.

A sum of £71,835 is to be taken this year from the municipal concerns in alleviation of local burdens; and, as on previous occasions, the gas undertaking contributes the lion's share—being made responsible for a contribution of £39,000, or all but about £10,000 of the net profits. Further, it is intended to allocate £18,000 from the tramway receipts; the remainder coming from the Electricity Department. The original proposal agreed to by the Finance Committee was to draw upon the gas undertaking for £34,000 only, or £2000 more than last year, which would have still rendered necessary an increase in the rate by 1d. in the pound. But the latter unpalatable necessity was averted at the last moment by the intimation of the preparedness of the Gas Committee to allot another £5000, or £39,000 in all—constituting a record in the history of the business. Party feeling still runs high in Nottingham municipal affairs, and, as a protest against the upsetting of the original report at a meeting for which hurried telegraphic notices were sent out, the Liberal members of the Finance Committee resigned *en bloc*—defending their attitude upon the score of the alleged unsound financial methods involved, particularly in relation to the gas accounts. The gas undertaking has for years been more or less the "milch cow" of the Corporation, and at Thursday's meeting it thus was appositely described by Mr. Douglas M'Craith, who is the Vice-Chairman of the Finance Committee, and who contributed some important figures during the debate. Sir Edward Fraser indicated the view entertained by the Liberal members as to the Finance Committee's scheme in general by moving, in a telling speech, its reference back for further consideration. Alderman Radford, also an ex-Mayor of the city, and a member of the Gas Committee, supported the protest made by Sir Edward in regard to taking the further sum of £5000 from the gas profits, particularly after the original proposal that the amount should be only £34,000 had been adopted by the Finance Committee. The latest socialistic acquisition to the Corporation—Mr. G. F. Berry, who represents one of the largest wards in the city—twitted both the political parties in the Council with ineptitude; arguing that the criticisms offered demonstrated that neither had any real idea how adequately to meet the needs of the city.

The debate on the Liberal side was continued in a spirit of strong objection to the undue demand which it was proposed to make upon the gas revenue. Interest was added to the discussion by the participation in it of Mr. Edward Harlow, who was Chairman of the Gas Committee at the time the dispute arose which led to the inquiry as to the management when Mr. J. H. Brown was Engineer.

The voting upon Sir E. Fraser's amendment was equal; and, as already mentioned, the Mayor gave his casting vote against it. The result is that £39,000 will be taken from the gas profits, without which, and the help from the tramways and electricity undertakings, Nottingham municipal finance would obviously be in a poor way.

Discussion in the City Council.

At the Meeting of the City Council last Thursday, the annual statement of the Finance Committee, which, as stated above, contained a proposal to take from the profits of the Gas Department £5000 more than was originally intended, gave rise to considerable discussion.

The Mayor (Mr. E. Mellor), who is Chairman of the Finance Committee, gave details of the estimated revenue, the total of which was £86,234, compared with £85,640 for the year 1911-12. The expenditure was put down at £408,091, and the amount required by the Education Committee was £105,272; making a total of £513,363, against an estimate of £506,763 for the past year. It was proposed, he said, to ask the Gas Department for £39,000, as against £32,000 last year, the Tramways Department for £18,000, the Electricity Department for £14,850, and the Bridge Estate for £4763. The total receipts in this event would be £76,643, compared with £67,655 twelve months ago The total receipts from all sources amounted to £155,188, compared with £148,708 last year; and as the total expenditure came to £513,363, it left a deficiency of £358,174 to be supplied. A rate of 6s. 5d. in the pound was estimated to produce £358,050, leaving an amount of £124 unprovided for. The Committee estimated that a rate of 1d. in the pound would produce £4654, and the rate would work out in this way: For Town Council purposes, 4s. 6¼d.; for education, 1s. 10¾d. His Worship concluded by moving the adoption of the report.

Mr. D. M'Craith, in seconding the motion, referred to some of the criticisms offered by a local paper on the subject of taking further sums from the trading concerns of the Corporation, which had been described as "an unprecedented and unwarranted raid on the undertakings." He said he thought that if the writer had studied the financial history of these undertakings he would not have made the remark. In past years, the gas undertaking was looked upon as the milch cow of the Corporation; and from 1899 to 1902 nearly the whole of the profit was taken. In 1899, for instance, out of £25,000 profit £24,000 was taken for the rate; and in 1900, £24,000 out of £26,000. In 1901, £27,000 was taken, leaving a miserable £123 to place to reserve. In 1902, when the profit was £24,516, matters were even worse, for every penny was taken for the rate. This year, out of nearly £50,000 profit, they were taking £39,000 – leaving the substantial sum of £10,710 to place to reserve or special account; and he failed to see how anyone who looked at the matter without partisan prejudice could describe the present position as an unwarrantable raiding of the profits.

Sir Edward Fraser moved, as an amendment, that the report be referred back for further consideration. He said the Finance Committee framed a report stating that a rate of 6s. 6d. in the pound was required. This was the deliberate judgment of the whole Committee. It was embodied in their report, and it was printed and circulated throughout the town. What would they say of a company in which they were interested if, within 24 hours of the issue of the statement of the accounts, they were told by the directors that the thing was all wrong, and that they could make a much better job of it? They would have a strong opinion of any board of directors who did such a thing. The recommendation of the Gas Committee was that out of a profit of £49,710 the sum of £34,000 should be handed over to the Finance Committee in aid of the rates. He would be curious to see how the Chairman of the Gas Committee dealt with the matter. The amended report—wisely confined to a few words—stated that they found the profits of the gas undertaking amounted to a larger sum than had been anticipated, and they recommended the Council to take £39,000 from them, and make a 6s. 5d. rate. "At the date when this report is made, therefore," said Sir Edward, "it is the Finance Committee who put their hands into the pockets of the Gas Committee and take away £5000 more than the Committee were willing to hand over. That is a piratical adventure which appears to have answered." He said he should have expected that the Chairman of the Gas Committee, with his experience of the difficulties of carrying on these large undertakings, would have resented this action on the part of the Finance Committee; but, finding that the money was gone, the Committee, he was told, had since consented—reluctantly, he was sure, to this sum being taken. This brought him to the point as to whether they were acting wisely in further raiding the gas undertaking. Mr. M'Craith had mentioned instances where in years gone by the whole of the gas profits, which were then moderate, had been appropriated. At that time, the amount taken in aid of the rates was some £24,000, or about 2 per cent. on the capital of the undertaking; and it should be remembered that the estimate then had always to be prepared before it was known what the gas profits were. It was, therefore, the closest estimate that one could make. It was important that the Council should thoroughly understand this, because he was afraid it was going to have serious consequences for the Corporation in the immediate future. The profits of the gas undertaking reached high-water mark in 1910, when £54,000 was obtained; and on that occasion £35,000 was paid in aid of the rates. Last year the profits had sunk to £47,000, and £32,000 was taken. This year they had increased by only £2000; and yet the Council were going to take £7000 more. By appropriating £39,000—the largest sum ever taken—they were actually taking out of the concern the equivalent of an 8d. or 9d. rate on the whole rateable value of the city. He thought he could undertake safely to say that there was not another place in the United Kingdom where such a state of things prevailed. As things were, if ever they had to go to Parliament to alter their gas undertaking law in any way, the amount they could take in aid of the rates would be limited to 1 per cent. At present they were taking 3½ or 4 per cent. on the capital. Sir Edward went on to predict that there would be an insistent demand for a reduction in the price of gas. It would naturally be argued that if they could afford to take a 10d. rate out of gas earnings, they could afford to make some reduction to the poor consumer. In the same way it would be argued that they could afford to give better wages and conditions to their workpeople. In speaking of the solid position of the undertakings, in conclusion, he submitted that the whole thing had been carried through more or less in a panic, and that the Finance Committee were selling the reputation of the Council as business men for a 1d. rate which they themselves declared was necessary.

Alderman F. R. Radford seconded the amendment. He said the budget was framed after taking from the trading concerns the full amount they could bear. The Finance Committee's report was printed and issued, and the matter was at an end so far as they were concerned. The next thing they heard was that a private meeting had been called of the Conservative Party to take the question into consideration. Only six members, including the Mayor, were able to get there in time. The proposal was to take a further £5000 from the gas undertaking. It was protested against by two members. By whose authority and on whose initiative was this sudden meeting called, and by what right, after the Finance Committee had already arrived at a unanimous decision? This was why some of the members had resigned.

Mr. T. Ward confirmed Alderman Radford's statement of what transpired at the "panic" meeting, and urged that he and his colleagues had good reason for their action in resigning, and throwing the onus of this remarkable "business" upon those who were responsible.

Mr. G. F. Berry, representing the Labour Party in the Council, said if they could afford to take from the gas profits the large amount stated, they could afford to supply gas at a lower rate.

Mr. Albert Ball, the Chairman of the Gas Committee, said that the concern was never in a sounder or more flourishing condition than it was now, and that it compared to distinct advantage with any other corporate concern of the kind in the country; there being only one other undertaking which could be said to be in a better position. When renewals were required some years ago, money was taken from the reserve fund. Upon one occasion, for renewal, at the Eastcroft works, £40,000 was taken from the reserve. But to-day the whole of the renewals were paid for out of revenue. There was a scheme now projected for rebuilding the Radford works, and they had £34,000 ready to pay for it. The reserve fund now stood at £156,702. This year, high-water mark had been reached, as considerable reductions in the charges made had been effected, compared with 1910, representing £11,000. The capital expenditure per 1000 cubic feet of gas sold in Nottingham was 11s. 8d., which was lower than in some other large towns; the reserve fund stood higher in proportion than that of any other undertaking in the country; and the wages paid to the workmen were better than in the past.

After some further discussion, the amendment was put, and the voting upon it was equal—28 for and a like number against. The Mayor had a casting vote; and he gave it in favour of the adoption of the Finance Committee's report.

Reports of the Gas Committee and the Engineer.

The annual report of the Gas Committee, with the accounts to the 31st of March, was issued on Friday, together with the first report of the newly-appointed Gas Engineer (Mr. John Wilkinson).

In the course of their report, the Committee state that the quantity of gas sold during the year amounted to 2,050,101,400 cubic feet, against 2,006,425,300 cubic feet in 1910-11; being an increase of 43,676,100 cubic feet. The total income for the year amounted to £344,807, and the total expenditure to £238,212; leaving a balance of £106,595 carried to the profit and loss account. After deducting the interest on the capital and sinking funds, and placing £2000 to the depreciation of stoves, there remains a net profit, with bank interest, of £49,710 at the disposal of the Council; being £2567 more than before. The Committee recommend that £39,000 should be handed over to the Finance Committee in aid of the general district rate.

The Committee express their pleasure in reporting that the markets for residuals were better than in the previous year, compared with which the income from the sales shows an increase of £6906. When presenting their report for 1910-11, they called special attention to the continued increase in the rates and taxes. The amount paid for that year was £20,866; while for the year 1911-12, it was £22,307—a further increase of £1441. If compared with the year 1906-7, when the amount was only £16,834, it is an increase of £5472, or an average increase of £1094 per annum.

There was an increase of 59 cubic feet in the quantity of gas sold last year per ton of coal carbonized; and the unaccounted-for gas was 53,872,600 cubic feet, or 2·56 per cent., compared with 82,037,700 cubic feet, or 3·93 per cent., the previous year. This is a record for the undertaking. The sum of £48,597 was spent on renewals, against £41,014 for 1910-11—an increase of £7583. At the Basford, Eastcroft, and Radford works, naphthalene washers were fixed during the year; considerable improvements were made in the coal-handling plant at Basford; and generally the works were kept in an efficient state of repair. Subject to satisfactory agreements being entered into, the Committee have made arrangements with West's Gas Improvement Company, Limited, for an installation of vertical retorts at the Radford works. It is intended to pay for the whole of this work out of a special fund which has been accumulating during the last three years for the purpose of remodelling these works. The Committee say this will mean the conversion of the oldest works into one of the most up-to-date plants in the Midland Counties.

Considerable improvements have been made at the Woodborough Road Depôt, including the provision of a large store for gas-cookers. Extensive renewals and improvements are in progress at the Giltbrook Chemical Works, which will be provided for out of revenue. The Basford and Eastcroft works, the Giltbrook works, and the distribution depôt are in good condition; and when the renewals and additions now in progress are completed, the works will, the Committee state, compare favourably with any similar undertaking in the country. They hope to have the vertical retorts at the Radford works ready for carbonizing coal in the early part of next year.

The following are extracts from Mr. Wilkinson's report:—

Manufacturing Department.

During the period under review, 178,226 tons of coal and 219,020 gallons of oil were carbonized in course of manufacturing the following products: Coal gas, 2,028,182,000 cubic feet; water gas, 75,792,000 cubic feet (equal to 3·6 per cent. of the total gas made)—total, 2,103,974,000 cubic feet. Coke (for sale), 74,570 tons; tar, 10,803 tons; ammoniacal liquor (10-oz. strength), 25,641 tons; sulphocyanide liquor, 14,394 gallons.

The tar was treated at the Giltbrook Chemical Works, and yielded products as follows:—

Crude naphtha	62,018 gallons.
Crude carbolic	10,524 ,,
Refined tar	100,133 ,,
Creosote	450,947 ,,
Brick oil	54,624 ,,
Pitch	6,287 tons.
Naphthalene	57 ,,
Ammoniacal liquor (10-oz.)	570 ,,

The Giltbrook works were also used for the manufacture of 2497 tons of sulphuric acid (100 per cent.), and 1510 tons of new oxide of iron. The manufacture of sulphate of ammonia is now confined to the Basford works (the plant at Giltbrook having been abandoned), and 24,917 tons of 10-oz. liquor were distilled during the year, producing 1920 tons of commercial sulphate of ammonia. In addition, 1107 tons of 10-oz. ammoniacal liquor were sold to outside chemical works, for the production of liquid ammonia.

During the latter part of the financial year, contracts were placed for the renewal of the Glover tower and No. 3 acid chamber at Giltbrook, along with the renewal and improvement of the sulphate of ammonia plant at Basford; and I am pleased to inform you that the work is progressing in a satisfactory manner.

With reference to the proposed installation of vertical retorts at the Radford works, I am informed by West's Gas Improvement Company, Limited, that they are pressing forward the preparation of the detailed plans and specifications, along with the necessary legal agreement; and it is probable that we shall be able to make an early start on the work. It will not, however, be possible to complete the erection of the installation until the early part of next summer.

It may be noted that, owing to the unrest and ultimate cessation of work by the coal miners, we were compelled to take 26,000 tons of coal out of stock up to the end of March last.

Distribution Department.

The following are the details of the sale of gas during the year; Ordinary consumers, 1,504,773,500 cubic feet; prepayment consumers, 448,009,500 cubic feet; public lamps, 97,318,400 cubic feet—total, 2,050,101,400 cubic feet. These figures compare very favourably with the total sale of gas for the previous year—viz., 2,006,425,300 cubic feet—and indicate an increase of 43,676,100 cubic feet, or 2·18 per cent. The gas unaccounted for during the year was 53,872,600 cubic feet, or 2·56 per cent., compared with 82,037,700 cubic feet, or 3·93 per cent, for the previous year. The decrease during the last few years is somewhat remarkable; and I am not at all sanguine that the present low percentage can be maintained. At the same time, we shall continue the special work which has been in operation for some time past, with the view of minimizing, as far as possible, the loss of gas through leakage.

There were 1556 additional consumers connected to the mains during the past year; thus making a total of 78,339 consumers at March 31 last, *plus* 7731 public lamps. The proportion of prepayment consumers to ordinary consumers is 49·55 per cent.; the proportion in the previous year being 48·33 per cent. The average consumption per consumer was 24,626 cubic feet, compared with 24,569 cubic feet.

The total mileage of mains is 394·36; 3·52 miles having been added during the year. There were 2287 new gas-services laid, against 2917 before. The number of meters fixed to March 31 last (including 486 lamp meters) was 78,825; being an increase of 1562. Of these, 75,998 belong to the Gas Department and 2827 to gas consumers. The demand continues for prepayment meters. At the end of the financial year, 39,062 of these were in operation; being an increase of 1722.

The application of gas for trade and domestic purposes, other than for lighting, continues to increase. There are at present in use about 32,067 cooking-stoves, 16,110 gas-fires, and 785 gas-engines, besides a very large number of other appliances of almost every description which have not been numbered. Of the 32,067 cookers in use, 9340 are rented from the department, and 22,025 are supplied with automatic meters rent free. It is interesting to note that the recent unsettled state of the coal market has resulted in a large increase in the number of applications received for free cookers.

General.

The latter part of the financial year was subject to the exceptional conditions created by the unrest, and final strike, of the coal miners; and many gas undertakings have been compelled to pay abnormally high prices in order to obtain sufficient coal to carry on gas-making operations. Indeed, many undertakings have been compelled to restrict the supply of gas to their consumers. The natural result of such conditions would be indicated in the accounts by a largely increased expenditure for coal, and a probable increase in the receipts for coke and other residuals. Your admirable foresight and judgment—first in procuring a huge stock of coal at contract prices, and secondly in purchasing coal for so long a forward period—has, however, placed the Nottingham undertaking in a most exceptional position.

The advantage derived from the first part of your policy is indicated in the present accounts by a reduced expenditure for coal, and a substantial increase in the receipts for residuals, as per the following figures:—

	Expenditure for Coal.	Receipts for Residuals.
1912	£89,045	£81,226
1911	90,470	74,320

The benefit derived from the latter part of your policy will be indicated in next year's accounts by an expenditure for coal which will not be inflated by large purchases at abnormal prices. Special note may also be made regarding the amount expended last year on repairs and maintenance of plant—viz., £48,597, compared with £41,014 the previous year. Another important factor is the increased receipts for gas sold—viz., £248,910, compared with £245,191. The actual result of the revenue account for the year 1911-12 is represented as follows: Total receipts, £344,807; total expenditure, £238,212—gross profits, £106,595. The gross profits for the previous year were £103,713.

Annexed to the report are tables showing the development of the undertaking during the last ten years, and the comparative workings per ton of coal and per 1000 cubic feet of gas sold for the years ended March 31, 1911 and 1912.

Evesham Gas Undertaking.—At last Wednesday's meeting of the Evesham Town Council, Alderman Fisher gave the members some information with regard to the excellent position of the gas undertaking. The revenue account for the past year, he said, showed total receipts amounting to £10,852, and an expenditure of £7920; leaving £2932 gross profit. The Committee recommended a reduction in the price of gas of 5d. per 1000 cubic feet, which would make the price 2s. 11d., and an increase of £40 in the salary of the Gas Manager (Mr. Percy H. Fletcher), making it £300. He expressed sympathy with Stratford-on-Avon in the great calamity that had occurred at the gas-works there. The recommendations were adopted; and a resolution of condolence with the Stratford-on-Avon Town Council was passed.

TRADING PROFITS AND THE RATES.

Increased Grant Taken from the Manchester Gas Department.

After a sitting extending over six hours, the Manchester City Council last Wednesday managed to "squeeze" the profit-earning departments to such an extent as to avoid any increase in the rates for the current financial year. As a member of the Council put it, the Gas Committee were "ordered" to hand over £50,000, *plus* a reduction of £10,660 in the price of street lighting. This was not done, however, without a vigorous protest from Mr. W. Kay, the Chairman of the Gas Committee. As previously stated in the "JOURNAL," the Gas Committee offered to contribute out of the profits £39,340 in aid of the rates, and to reduce the cost of street lighting by £10,660.

When the Committee's estimates came before the Council, Alderman Goldschmidt moved, as an amendment to the motion for their adoption, that the contribution be increased from £39,340 to £50,000; and this was seconded by Alderman Holt. Seeing how matters were going, Mr. Kay offered £45,000; and Alderman Holt said he would agree to this if the mover of the amendment accepted. The Lord Mayor (Councillor Royse) at this stage observed that if Alderman Goldschmidt and Alderman Holt would accept £45,000, no doubt the Council would agree. Alderman Goldschmidt, however, would not give way; and on the matter being put to the vote 43 members were found in favour of the contribution being raised to £50,000, and 34 against it.

Alderman Goldschmidt was also responsible for the resolution by which the Electricity Committee have to hand over £24,500, instead of £19,496 as at first proposed. Alderman Holt, who seconded the motion having this object, said the Committee could easily afford a very much larger sum than was offered. When it was considered that the Corporation had supplied a capital of £2,800,000 for the convenience of some 10,000 consumers, it became evident that it would be unfair to the rest of the ratepayers if nothing was got back from the undertaking. The prices charged and the profit made by the Committee had steadily declined; and he declared, that if the Council accepted the Committee's proposal, the profit would practically vanish altogether. "It is an easy matter," he said, "to build up a large business if you give away your stock. What the Council ought to insist upon is that this department shall be run on business lines. What is a return of £19,000 on a capital of £2,780,000?"

Contributing to the discussion, Mr. Kay complained of the unfair treatment meted out to the Gas Committee compared with the Electricity Committee, and submitted that the latter were now supplying current at too low a price in some cases. In his reply, the Chairman of the Committee (Mr. G. Howarth) claimed that in selling the current at a cheap rate they were doing excellent work. By this policy they not only induced capitalists to establish works in the city, but were also doing a great deal towards solving the smoke problem.

On the matter being put to the vote, 55 members were in favour of the grant being raised from £19,496 to £24,500 (which is the same as last year), and 25 against it.

It was resolved to take an extra £15,000 from the tramway profits; making £100,000 in all from this department. With some slight paring of the estimates of the spending Committees, the Council were able to wipe out the 2½d. in the pound increase in the rates which faced them at the opening of the meeting.

A Protest at Salford.

A Special Meeting of the Salford Town Council was held on Thursday, when the estimates for the year were dealt with. As the result of some of the trading committees agreeing to hand over larger sums than was at first proposed, the Council were able to fix the total rate at the same level as last year—namely, 6s. 9d. in the pound. In the course of his address to the Council, Alderman T. H. Jenkins (the Chairman of the Finance Committee) stated that the total amount to be found was £355,927, which was £110 more than last year. Towards this the trading committees estimated to hand over out of profits a total of £48,000, as against £47,000. Of this amount, £18,000 was from the Gas Committee, the same as last year; and the Electricity Committee, who at first proposed not to contribute anything, had agreed to give £7000. Then the Water Committee would hand over £4000, and the balance came from the Tramways Department. One councillor had a good deal to say about the pressure which, he alleged, had been brought to bear upon the trading committees to hand over more money in relief of rates than the respective departments could properly afford. Personally, he regarded this as bad finance, and would always raise his voice in protest against such a practice. He took particular exception to the Water Committee being compelled to hand over £4000; contending that it was not right to make profit out of the water supply. On the general question of forcing the trading committees to give more than was at first offered, he declared it tended to the sacrifice of efficiency for the sake of economy.

SALFORD AND SUPPLY OF GAS TO OUT-DISTRICTS.

Local Government Board and Limitation of Profits.

The Local Government Board have submitted to the authorities concerned a copy of the Provisional Order to be laid before Parliament for confirmation, and issued in response to the recent application made by the Salford Corporation with regard to their gas undertaking. The Council asked for sanction to borrow £250,000 for the acquirement of land and extensions at the gas-works, and also sought authority to reduce the illuminating power of the gas from 18 and 17 candles to 14 candles.

At the Local Government Board inquiry (which was reported in the "JOURNAL" for Feb. 27, pp. 608-10), opposition was offered to the application by a number of the authorities whose districts are included in the Salford Corporation gas supply area. On the second day of the inquiry, Counsel appearing for the opposing authorities submitted conditions under which they would withdraw opposition to the Provisional Order asked for. These included limitation of the amount taken from gas profits in relief of rates—the sum of £10,000 being named; that there should be no differential charges for gas in Eccles, Swinton, Worsley, or Barton; and that the Corporation be entitled to carry to a reserve fund £7000 per annum till £70,000 was reached, with the right to maintain it at this definite figure in the future. For the Corporation, it was urged that the proposed £10,000 was much too small a sum, and that the amount should be £20,000. But on this and other points the Corporation placed themselves unreservedly in the hands of the Local Government Board: relying upon the evidence given at the inquiry to show that the £10,000 was quite inadequate, having regard to all the circumstances. An undertaking was given then on behalf of the Corporation that, in the event of the department deciding to abolish the differential charges for gas to the out-districts, Irlam and Prestwich, who did not oppose the granting of the Order, should have the same concession.

The draft Order of the Local Government Board, in response to the Corporation's application may be divided into three parts. Under the first, sanction will be given the Corporation to borrow the £250,000 for the acquirement of land and gas-works extensions. By the second section, authority will be given the Corporation to reduce the illuminating power of the gas supplied to 14 candles. The chief clauses in the third part dealing with the question of the application of gas revenue may be summarized as follows.

> In payment of the working and establishment expenses of the gas undertaking, and the cost of the maintenance, renewal, and repair of the gas-works of the Corporation.
>
> In the payment of the interest on the moneys borrowed or reborrowed for the purposes of the gas undertaking.
>
> In annual payment of the sum of £2089 16s. to the credit of the borough fund of the borough, until the moneys borrowed or reborrowed under certain Acts cited have been paid.
>
> In annual payment of £10,000 to the credit of the borough fund of the borough.
>
> The Corporation may carry to the credit of the reserve fund account in any one year a sum not exceeding £7000, in addition to any sums which the Corporation may require to apply out of the revenue of the gas undertaking; that the sum standing to the credit of the reserve fund account shall not at any time exceed the sum of £70,000.
>
> The residue (if any) of the moneys received by way of revenue from the gas undertaking, after meeting all the charges set out, is to be carried forward to the revenue account of the gas undertaking for the next succeeding year, and shall (whenever, and so soon as, the amount so carried forward exceeds the sums required to meet the purposes named in the schedule for one year) be applied to the reduction of the price of gas supplied by the Corporation.
>
> Any deficiency in the revenue of the gas undertaking in any year shall be made good out of the reserve fund to be established, or, if the reserve fund shall be insufficient for the purposes, out of the district fund of the borough; and the amount of the deficiency shall in each case be a debt due to, and shall be repaid to, the reserve fund or district fund, as the case may be, out of the revenue of the gas undertaking.

The article dealing with the price of gas is as under:

> Notwithstanding anything in the local Acts, the price, rent, or rate at which gas shall be supplied by the Corporation to private consumers, or for the purpose of public lighting within the outside limits of supply, shall not, as from March 31, 1913, be higher in similar circumstances than the price, rent, or rate at which gas is supplied by them (the Corporation) to consumers of gas, or for the purposes of public lighting, within the borough.

Summing up the position, our Manchester correspondent says it would seem that, by the terms of the proposed Provisional Order, the outside authorities have succeeded on most of the points they put forward. The amount to be taken from gas profits in any one year for the relief of rates is limited to £10,000. There is, of course, the additional sum of £2089 16s., about which a good deal was said at the Local Government Board inquiry, as to whether it was a legitimate charge on the Gas Department or not under an old Act of Parliament. The outside districts have also secured the abolition of preferential charges for the gas supplied to them, as from March of next year. To consumers in Irlam and Barton, this means a reduction of 5d. per 1000 cubic feet; and those in the Prestwich and Worsley districts will have a reduction of 2d. per 1000 feet. Eccles and Swinton, it may be mentioned, are at present supplied at the same price as consumers in Salford. The outside authorities are also to have the right of inspection of the accounts of the gas undertaking, and will be entitled to reasonable costs incurred in opposing the Corporation's application at the recent Local Government Board inquiry.

The draft Order is submitted to the outside authorities for observations thereon before being submitted to Parliament.

Last year the Gas Committee of the Salford Corporation handed over in relief of rates £18,000; and they estimate to give the same amount for the current year.

Portsmouth Water Company.—The report of the Directors of this Company for the half year ended March 31 shows that the available balance amounts to £25,269. The Directors recommend the payment of the full statutory dividends; and, after making deductions for void houses, &c., a sum of about £5141 will remain to be carried forward. The quantity of water pumped from Havant and Bedhampton during the half year was about 1471 million gallons, or an average daily supply for all purposes of 8,036,907 gallons—an increase of 350,875 gallons daily as compared with the corresponding period of 1910-11. The Admiralty having made representations, and application having been made to the Company by the Rural District Council of Fareham, that they would supply the inhabitants of Portchester with water, the Directors propose to apply to the Board of Trade next session for a Provisional Order to authorize such a supply.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

Annual Accounts—Vertical Retorts for Windsor Street—The Late Coal Strike.

In the report which the Gas Committee of the Birmingham Corporation will present at a special meeting of the City Council to be held to-day, reference is made to the contract recently entered into for a large installation at the Windsor Street works of Woodall-Duckham vertical retorts, and also to the effects on the undertaking of the national coal strike. Attached to the report is the statement of accounts for the year to March 31.

With reference to the contract with the Woodall-Duckham Company, the Committee say that it had become necessary to renew some of the retort-benches in the retort-house at the Windsor Street works, which were entirely worked out; and after giving the subject careful consideration, they decided that the better course to adopt would be to undertake a scheme of reconstruction. Tenders were accordingly invited for the installation of (*a*) horizontal retorts with various kinds of charging and discharging machinery, (*b*) vertical retorts with intermittent carbonization, and (*c*) vertical retorts with continuous carbonization. A close comparison was made of the tenders received, with a view to determining the most economical method of working for the house in question, based upon the cost of production and the quantities and values of the various residual products. As a result of the Committee's investigation, it was decided to instal 22 beds of vertical retorts for continuous carbonization, of a total productive capacity of 5 million cubic feet per diem; and the tender of the Woodall-Duckham Company was accepted for the erection of the necessary plant, at a cost of £57,432. The plant is very simple in design; and the cost of repairs will, under the Company's guarantee, be reduced to a minimum.

The Committee regret to report that, in consequence of the protracted coal strike, which lasted from March 1 to April 9, they deemed it advisable to restrict the output of gas from the works as follows: April 1 to April 4 inclusive, from 1 p.m. to 7 p.m. each day. April 5 (Good Friday) to April 10 inclusive, from 4 a.m. to 11.30 a.m., and from 1.30 p.m. to 7 p.m. each day. This course was taken to assist in conserving the available stocks of coal and gas oil at the several works, and to avoid the possibility of a total cessation of output.

In June last, the Committee entered into contracts for the delivery over the twelve months ending June 30, 1912, of a larger quantity of coal than they had ever purchased in one year; and, in addition, they secured 15,544 tons of coal which were delivered on to the works in the early autumn. The bulk of the coal carbonized at the works is drawn from collieries distant about 70 miles from Birmingham; and the Committee are entirely dependent upon the Railway Companies for its conveyance. The railway strike in August last dislocated the railway services to such an extent that deliveries of coal under contract fell considerably into arrear, with the result that, though special efforts were made throughout the autumn and winter to expedite the conveyance of coal from the collieries to the works, the stocks held by the department at the end of February were much lower than they otherwise would have been, and deliveries under contract were about 25,000 tons in arrear. Moreover, the available stocks were further depleted by an abnormally heavy consumption of gas in the months of December, January, and February last, such as had never previously been experienced; the increased output alone necessitating the carbonization of coal and gas oil equivalent to about 24,000 tons.

Nominally the coal strike did not commence until March 1; but several collieries from which the department were drawing coal closed down during the week preceding this date. It was not possible during the strike to obtain delivery of more than small quantities of gas coal, as, though various tonnages of coal and slack were offered during the period, very little was of any service to the department, as it was not material suitable for gas making. Notwithstanding these facts, the Committee had sufficient coal and gas oil on hand at the commencement of the strike to enable them to maintain a normal output of gas for at least six weeks; and it was not anticipated at the beginning of March that the total cessation of coal supplies would be of such long duration as it afterwards proved to be.

Towards the end of March, the outlook was so uncertain, and the prospect of an early settlement of the dispute appeared so remote, that the Committee were unwilling to risk the total depletion of their coal and oil stocks—particularly as they were advised that it would probably be a week or more after the resumption of work at the pits before supplies of coal would be coming forward. They therefore suggested to the lighting authorities, both within the city and in the various other districts within the area of gas supply, that the lighting of the street-lamps should be considerably curtailed; and in every case the surveyors of the districts readily complied, and made arrangements which reduced the consumption of gas for street lighting without causing undue inconvenience to the public. On March 18, the Lord Mayor officially appealed to consumers to exercise every possible economy in the use of gas, as, unless the outlook materially improved before the end of the month, a restricted supply of gas would be inevitable; and this course unfortunately had to be adopted to the extent before mentioned. Having regard to the fact that the greater portion of the ten days of restricted output was covered by the Easter Holidays, the Committee hope that the inconvenience thereby caused to consumers was minimized.

During the strike the Committee were in a position to continue a supply of coke to bakers and other food suppliers, and to public institutions. In view of the scarcity of fuel, they did not feel justified in taking advantage of the situation by increasing prices; and consequently the price list ruling before the strike was not disturbed. They made special arrangements for the supply of coke to those people who can only purchase fuel in small quantities; and that such facilities were much appreciated is, it is pointed out, evidenced by the fact that no fewer than 86,391 sales of coke in ¼-cwt. and ½-cwt. lots were made in the six weeks covered by the strike—the largest number of customers supplied in any one week being 25,568.

The accounts show a surplus for the year to March 31 of £80,681, which, with £3283 interest on the reserve fund, will be paid over to the Finance Committee in aid of the improvement rate of the city. During the past year, a sum of £53,614 was spent on capital account (£3248 of it being for branch offices, £13,249 for extension of buildings, £15,514 for new mains, and £21,603 for new meters not in place of old ones); bringing up the total expenditure to £2,482,075. Deducting the value of buildings and plant abandoned (£65,793), a sum of £2,416,282 is left, which is £492,667 less than the total receipts (£2,908,949). The revenue from the sale of gas amounted to £718,283 compared with £743,047 in the preceding year; while residual products realized £292,800, against £265,343. The total receipts were £1,017,276, compared with £1,016,789. On the other side of the revenue account, under manufacture, coal (including oil, carriage, unloading, and all other expenses of depositing same on works) cost £398,823, against £377,968 the preceding year; purifying materials and wages, £5211, against £8123; wages at works, £73,921, against £76,438; repairs, maintenance, and renewal of works, plant, retorts, machines, apparatus, and tools (less old materials sold), £172,741, against £179,208. The total cost of distribution was £85,063, compared with £81,583; and the remaining items brought the expenditure up to £822,324, against £805,035 in 1910-11. There is thus on the present occasion a balance of £194,951 to be carried to the profit and loss account, compared with £211,754 in the previous year. After meeting interest and other charges, there is a net balance of £80,681, which compares with £75,621 last year.

The quantity of coal carbonized during the past twelve months was 594,548 tons, and of gas oil used 4,498,796 gallons. The gas sold and consumed on the works amounted to 8,089,641,400 cubic feet. The average net price of gas was 1s. 9·31d. per 1000 cubic feet, compared with 1s. 11·18d. Coke and breeze realized £159,500; tar, £60,895; ammoniacal liquor, £72,116. The estimated quantities made were: Coke, 305,813 tons; breeze, 58,051 tons; tar, 7,073,404 gallons; ammoniacal liquor, 24,871,601 gallons. Of coke, 226,681 tons were sold, and 77,927 tons used.

The following are some statistics of the gas undertaking for the years ended March 31, 1911 and 1912:

	1911.	1912.	Increase.
Gas sold (cubic feet)	7,693,859,300	8,089,641,400	395,742,100 = 5·14 per ct.
New services laid	8,545	7,474	1,071 [Decrease.]
Cooking and heating stoves sold during the year, and on hire at March 31	12,759	22,232	9,473
Total number of cookers supplied to prepayment consumers at March 31	63,460	70,926	7,466
Total number of prepayment meters fixed, do.	75,595	82,028	6,433

HEYWOOD GAS DEPARTMENT.

Report and Accounts for the Past Year.

In the "JOURNAL" last week (p. 457), brief reference was made to the result of the working of the Gas Department of the Heywood Corporation in the year ended the 31st of March. The following additional particulars are taken from the report, accounts, and statistical tables for the period named, a copy of which has been sent by the Gas Engineer and Manager (Mr. W. Whatmough).

The gross revenue amounted to £22,966, and the gross expenditure (less interest and sinking fund) to £15,902; leaving a gross profit of £7064. As the interest and the payment into the sinking fund amounted to £5484, there was a net profit of £1580—an increase of £432 on the amount for the year 1910-11. The revenue from the sale of gas was £17,449, compared with £17,084 before, or an advance of £365. Residuals produced £5170, against £4665, or £505 more, due principally to the higher price realized for tar and sulphate of ammonia. A sum of £260 more was spent on the manufacture of gas, owing to the re-setting of retorts and the repair and maintenance of the old retort-bench. During the year, 721 tons of cannel and 11,603 tons of coal were carbonized—together, 12,324 tons; and the gas made per ton was 10,803 cubic feet. The total quantity of gas manufactured was 133,142,000 cubic feet, or 781,000 cubic feet less than before; and the quantity sold was 128,742,151 cubic feet, or 3,411,151 cubic feet more. The unaccounted-for gas was 3,806,349 cubic feet, or 2·32 per cent.—a decrease of 3·11 per cent. on the year 1910-11, and equivalent to a saving of 4,140,716 cubic feet. There was a decrease in the quantity of gas consumed in dwellings and shops through ordinary meters, as well as in mills and workshops and for the public lighting. The consumption by prepayment meters and stoves and for motive power was greater by 1,892,260 and 2,630,300 cubic feet respectively.

Mr. Whatmough says in his report that for many years the question of modernizing the retort-house has been under consideration; and during the past year it was decided to erect a new bench of vertical retorts on the Glover-West principle, equal to a production of 500,000 cubic feet per day. The work is well in hand, and it is expected that the installation will be brought into use before the next lighting season. The recent coal strike was necessarily a source of anxiety to the Gas Committee; but the department was equal to the occasion, and maintained a constant supply of gas with the exception of the curtailment in the lighting of the public lamps. The adoption of the free maintenance of incandescent burners in public places of worship and schools has proved beneficial; and Mr. Whatmough suggests its extension to all consumers, upon application, throughout the district of supply.

Hill's Gas Plants, Limited, has been registered with a capital of £75,000, in £1 shares, to carry on business as manufacturers of, agents for, and dealers in, gas plants and accessories, &c.

COVENTRY CORPORATION GAS UNDERTAKING.

The Past Year's Working.

According to the report for the past financial year which has just been prepared for presentation to the Coventry City Council by the Gas Committee, the working of the undertaking in their hands has again been attended by success. During the year the sum of £1874 was expended on capital account in respect of new mains, and £1967 received for freehold property sold. The total capital expenditure since the acquisition of the undertaking has been £479,780; but a sum of £29,000 has already been set aside towards meeting the loss of capital consequent upon the abandonment of plant at the old works, thus reducing the actual expenditure to £450,780. The borrowing powers exercised amount to £479,805; so that there is at present in hand £29,025. The revenue from all sources last year amounted to £157,175, and the working expenses to £111,737; leaving a gross profit of £45,438, compared with £40,620 in the preceding year. To this amount has to be added £884 brought forward and £379 for bank interest; thus increasing the total to £46,701. The capital and other charges amounted to £22,147, against £22,058 before; so that there is a surplus available of £24,554, against £19,384. The reserve fund amounts to £9854, of which £7692 is invested in Consols (written-down to the present value of 78½), £1496 is on deposit, and £666 in current account awaiting transference. In pursuance of the recommendation adopted by the Council last year, the work of erecting purifying plant at the Foleshill works is in progress. The Committee recommend the Council to deal with the available surplus as follows: To pass over £5000 in aid of the rates; set aside £19,000 towards meeting the loss of capital consequent upon the abandonment of plant at the old gas-works (making with the amounts previously set aside £48,000 out of an estimated loss of £67,000); and apply a sum estimated at £450 in payment of a bonus to the employees of the department—the balance to be carried forward. The Committee propose that the charges for gas should be reduced by 2d. per 1000 cubic feet throughout the scale.

TIVERTON CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The Chairman of the Gas Committee of the Tiverton Corporation (Alderman John Thorne) presented, at the meeting of the Town Council on Monday last week, a summary of the past year's working of the gas undertaking. Referring to the coal strike, he said the only inconvenience suffered was the curtailment of the public lighting. The year had been one of progress. The sale of gas produced £7724—an increase of £66 over the figures for the previous twelve months. For residuals, £1957 had been received, or an advance of £115. The sale of sulphate of ammonia produced £437 more. The total receipts were £10,198, against £9580 for 1910-11; and the gross profits amounted to £3534, against £2861. The standing charges were £2832—leaving a net profit of £702, which was the largest made since the works were taken over by the Corporation. The capita expended on the gas undertaking was £37,061; and £20,743 had been paid off, including the sinking and reserve funds. The total indebtedness up to March 31 amounted to £16,318. In 1917, the sum of £26,00 owould be paid off; so that if they did not add to the capital between now and then, the liability on the undertaking would stand at rather more than £11,000—leaving property owned by the town valued at between £50,000 to £60,000. The satisfactory report was the outcome of the ingenuity, industry, and ability of the Gas Manager (Mr. Clark Jeffery). The Mayor (Mr. A. T. Gregory) also commented on the excellent report, and referred to the Manager's attention to his duties.

CAPE TOWN DISTRICT GASLIGHT AND COKE COMPANY.

An Improved Position of Affairs.

The Ordinary General Meeting of this Company was held last Wednesday, at Egypt House, New Broad Street, E.C.—Mr. J. E. Lilley, J.P., in the chair.

The Secretary (Mr. R. W. Blackburn) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, said that during the year to Dec. 31 last they had made a profit of £1472 more than in the preceding twelve months, and this in spite of the fact that the price of gas over the last half of the year had been reduced by 7d. per 1000 cubic feet. Out of the amount earned, debenture and debenture stock interest had been paid, £3091 had been written-off for depreciation, and £5444 had been placed to reserve and contingency account. There was left a balance of £2129 to be carried forward. Though the Company had made rather more profit in the past year, they had been subjected to even keener competition than at any previous time. The price of electricity as supplied by the Municipality of Cape Town had been still further reduced. The Municipality had obtained permission to go with their electricity into nearly all the districts to which the Company supplied gas, and had been actively engaged in canvassing for customers throughout these areas. He did not quite know how they could be justified in using the money of the Cape Town ratepayers in carrying on business in adjoining municipal districts, and competing so very severely with one of their own largest ratepayers and one of the biggest wage-distributors in Cape Town. But this was the state of things against which the Company had to contend; and he was pleased that the Company had been able to do as well as they had done. There was, however, one thing which it had deprived them of the power of doing—it had prevented them from reducing the price of gas to such an extent as would have been possible had there not been this severe competition. With increased business the Company could afford to sell gas more cheaply than they were doing at the present time. It was the great desire of the Board that, when they were able to make distributions to the shareholders, the customers and residents in the places they served should enjoy a lower price for gas. Notwithstanding the competition, the Directors still hoped to accomplish these aims. While they had had a good deal to struggle against, they had, on the other hand, by the re-organization of the works, by improved methods, and by the economies they had been able to effect through scanning every year the whole of the departments which constituted the concern, succeeded in making gas more cheaply; and therefore, though they had sold it at lower prices, they had made a fair profit. He felt certain that they had now got through the worst of their troubles. The shareholders would remember the severe set-back experienced some years ago, when the population began to decrease, and continued to do so rapidly for a long time afterwards. When a population was decreasing, it was very difficult to keep up the business of the supply of gas. It was chiefly in places that enjoyed a growing population that increases in gas consumption were experienced. Then, again, legislation took place some time ago, compelling all the shops to close early in the evening, so that for only a short period was artificial light needed, except on Saturdays. The Company knew what difference this made to them, because the sales of gas on Saturday were now very much larger than on any other day—in fact, they were fully one-fifth more. The last disadvantage the Company had suffered from was the removal of the Government offices from Cape Town to Pretoria. This had dealt the Company a hard blow, by taking away the well-paid officials of the Government. Of course, many other business people in Cape Town had suffered from the same cause; and there had been a loud out-cry on the part of those engaged in commercial operations there. During the past year, the Company had been able to get rather better results from their coal. The make of gas per ton had been higher than ever before; but they did not get the full value of this in their income, owing to the reduction in the price of gas. Further than this, he was sorry to say that the leakage was still very heavy, in one sense; and the Board were anxious that it should be brought down. The Engineer was fully alive to the necessity for reducing it, and was making every effort to this end. But figures might be made to prove almost anything; and although 20 per cent. appeared to be very high, when one considered the mileage of mains, and compared it with even the best of the London Companies, it would be found that the percentage was really low. Whereas their losses by leakage in Cape Town only amounted to 267,300 cubic feet per mile of main, the loss in the case of one of the biggest companies in London came to about 487,000 cubic feet per mile. This was a point of view which must be taken into account in order to be fair; and, when it was considered, they in Cape Town were really doing remarkably well in this matter. He would not say that either the percentage of leakage on output or the percentage per mile of main was the final and complete test of loss, because there was also the loss from service-pipes to be taken into account; and there were, of course, more service-pipes per mile of main in London than in Cape Town. However, considering everything, they were bound to come to the conclusion that the leakage in Cape Town was well looked after. In fact, the Board knew it was so, because for some time they had given great attention to it. They had requested the Manager to send over a record of the positions in which leakages were found, so that they might be able to see whether trouble occurred in the same place again or in different spots. If the leakages were repeated in the same place, they would take steps to ascertain whether this was due to improper work or to some special cause. Personally, he had no doubt that the work had been done properly; and the Directors were satisfied that the work carried out by their present Manager had been performed with the greatest care and attention in every respect. Coal had cost them 5d. per ton less than in the preceding year. Freight was the same; but they had managed to make other savings in the passage of the coal from the ship to the stores. This was a distance of some few miles; and carriage was expensive out there. Altogether, they had succeeded in making a saving of 1s. 2d. per ton in the cost of coal as delivered into the stores. The average amount of gas sold to each customer, as measured by the meters, had been reduced by over 8s. This was to some extent accounted for by the fact that they had had to take on smaller consumers than in past years, and also partly by the reduction in price. But in one department the results showed some improvement, and this was in regard to prepayment meters. These seemed to be the Company's great stand by. Some big ordinary consumers, like hotels and churches, who would have the electric light, were lost; but at the same time they were largely increasing the number of their consumers in the direction of automatic meters. In this connection, he might remark that they had been able to adapt the old ordinary meters to the prepayment system. The money losses during the year from prepayment meters came to a very small sum—only £1 19s.—whether from thefts or from other causes; and this was from some thousands of the meters. Residuals had yielded better results; but they were still a very long way in this respect from the position they held some years ago. They had had to disconnect 1219 meters in the twelve months, which meant that about one-fifth of the whole of their customers made a change at some time or other during the year. On the other hand, however, they had connected 1440 supplies—showing a net gain of 221. Some 300 yards of new mains had been laid, and 276 new services; and there had been fitted up 458 prepayment installations, 404 additional cookers, and other appliances. A competent man had been sent out to look after the distribution department generally; and the result had been very satisfactory. As to legislation, this was really advancing; and the Board had at last been favoured with information with regard to the proposals of the Government for the control of gas companies. They had been heard on the subject by the officials, and consideration had been given to the views they had expressed. What the final result would be, he could not say; but if the Bill was passed with which the Government seemed at present satisfied, he did not think the Company would complain. The Directors were holding themselves ready to do everything that could be done to secure that the terms should be fair. The item of repairs and maintenance showed

that a very large sum had been expended. It must, however, be remembered that the Company had no capital to expend during the past year; and though they had had to put in many new installations, this had not enabled them to appreciably increase the business, and the Board had decided that expenditure necessary to keep the business up to its present mark should be charged to revenue. All the new services, mains, and prepayment installations, therefore, had been paid for out of the year's revenue. In addition to this, £5000 of debentures had also been redeemed out of revenue. For the present year, he was sorry to say, the Company had had to pay considerably higher prices for some of their coal. In spite of all their efforts, they had been unable to find coal in the Colony which it would answer their purpose to use. There was some coal from near Johannesburg from which gas was made; but the cost of getting it to Cape Town, as compared with that of the present supply, rendered its use prohibitive. Some money would have to be spent on new retorts, partly this year and partly next year, which would result in more economical working. Intimation had just been received that the Company had secured a new contract for the lighting of the streets of Mowbray for a further period of ten years after the expiration of the existing contract. The Engineer was zealous in doing everything he could to promote the interests of the Company; and during the time he had been in charge of the works, he had made great improvements. The other officers, also, had rendered excellent service.

The VICE-CHAIRMAN (Mr. H. R. Savory) seconded the motion.

The CHAIRMAN, in answer to a remark by a shareholder, pointed out that the Company had really had a prosperous year, and that had it not been for the loads that had to be removed a dividend could have been paid. The Board were clearing away this incubus, and putting the Company in the strongest possible position; and he felt sure it was in the best interests of the shareholders that they should be patient a little longer.

The report was then adopted, the retiring Director (Mr. Savory) and the Auditors (Messrs. C. F. Kemp, Sons, and Co.) were re-elected, and a vote of thanks was passed to the Chairman and Directors.

SOUTH BARRACAS (BUENOS AYRES) GAS COMPANY.

The Ordinary General Meeting of this Company was held on Thursday last, at the London Offices, No. 1, East India Avenue, Leadenhall Street, E.C.—Mr. J. C. IM THURN presiding.

The CHAIRMAN, in moving the adoption of the report and accounts (which were noticed in last week's "JOURNAL," p. 458), said he did not think there was much in the figures which called for special remark. In the revenue account, the item of "Profit other than trading, sale of investments, £4246," referred to the proceeds of a sale of Province of Buenos Ayres Water-Works Company's "B" shares, of which shares their Company now held a further 5000, standing in the balance-sheet at their nominal value, £250. Turning to the balance-sheet, the additions to the property of the Company, £14,034, were made up chiefly of extensions of mains, &c., and also included the sum of £7104 spent in acquiring property to the extent of about 1¾ acres in their district of Avellaneda. It had been found necessary to secure this in order to concentrate the repair shops, stores, and offices. It was obtained at what the Directors considered to be a very reasonable price. As the Company did not at present need the whole of this property, a portion of it had been rented to the Province of Buenos Ayres Water-Works Company. It would be seen by the report that though the business done had been larger, the results had not been commensurate; and the Board much regretted that the trading profit was so disappointing. One reason for this had been quite beyond their control—namely, the inundation of the works in April of last year; the flooding being so complete that the supply of gas had to be entirely suspended for four days. Indeed, it was some time before it could be fully re-established; and this naturally caused the Company, besides other prejudices, considerable expense in repairing the retorts and in cleaning up the works. This item accounted for an increase over the previous year of £685. Maintenance of mains and services, due in a great measure to subsidences caused by the flood, entailed a further increase of £855. In addition, they had to make considerable use of their carburetted water-gas plant, which, however useful, and even indispensable, for an emergency, was not economical as compared with carbonizing only coal. The increased cost of this accounted for £1053. All these outlays were due to the flooding; but the year had also had to stand the expense, which was considered necessary, of thoroughly overhauling the meters, cookers, stoves, and internal fittings let out on hire to the consumers. These had now been put into perfectly good order, and, where necessary, replaced by more modern appliances. In accordance with their usual practice, the cost of all this had been met out of revenue; and the distribution charges had been increased by some £2250. Though the year under review was very adversely affected by the floods, this did not, by itself alone, in the opinion of the Directors, account for the meagre net trading profit. The fact was that, shortly after their meeting in April, 1911, feeling dissatisfied with the accounts they were receiving, they took steps to make special investigation on the other side, the result of which was that their Manager resigned. The Board had now secured the services of Mr. R. B. Brown, who came to them with very high testimonials. He arrived in South Barracas some weeks ago, and was now in charge of the works there. There was every reason to hope that henceforward they would obtain better results. He might add that the indications which the Directors were now receiving were favourable; and he fully expected that when they met the shareholders next year, they would be able to give them a more satisfactory report. The district they were serving continued to develop—houses being constantly built in large numbers; so that they might look forward to an increase of business from this source. He thought he might add that in other directions important extensions of their business were now practically assured. For instance, one of the principal railways had decided to discontinue manufacturing gas for lighting their stations and coaches; and the Gas Company had been approached with a view of supplying the gas required. Though the proposed contract had not yet been definitely settled, they were told they might expect this would come about. The Company had also been approached by the Lomas municipal authorities to extend their mains to the important district of Talleres; and as the Manager reported that profitable business would be assured by such an extension, the Board had authorized the carrying out of the work. In this connection, the opportunity had been taken of discussing with the Lomas authorities the present public lighting contract; and he was pleased to say they had had a cablegram informing them that there was every prospect of obtaining a new contract for ten years at a good price (on the expiry of the present one in three years' time), with a large increase of public lighting. The latest letters received reported that considerable progress had been made in pushing business generally and energetically. New showrooms, which should be of great benefit, had been opened, and were in full working order. The high prices that had now to be paid for coal and freight were rather against any great immediate improvement; but the outlook under the new management was good, and the Directors felt confident the Company had an exceptionally favourable field for business in the district they served.

The report was adopted, and a dividend of 2 per cent., making 4 per cent. for the year, free of income-tax, was declared. The retiring Directors (Mr. J. C. im Thurn and Mr. Ross Pinsent) and the Auditors (Messrs. Arthur Goddard and Co.) were subsequently re-elected.

LOCAL TAXATION PROBLEMS.

The Association of Municipal Corporations held their meeting at the Guildhall, E.C., last Tuesday; the chair being taken by the EARL of DERBY (the President).

Mr. J. S. HARMOOD-BANNER, M.P., the Chairman of the Council, in the course of his speech in moving the adoption of the report, remarked that on the subject of local and Imperial taxation there was little fresh to say. Last year, the Government appointed a Departmental Committee; but they had imposed very onerous duties upon this Committee, so as to unduly prolong their deliberations, with the result that their report had not yet been issued. This the Government had taken as an excuse for making no provision for relieving local taxation. An amendment was moved to the address in reply to the King's Speech, expressing regret that, having regard to the rapidly growing cost of education and other services of a predominantly national character, and to the additional duties cast upon local authorities by legislation and departmental administration, involving heavy and increasing burdens on local rates, the King's Speech contained no announcement of measures to give effect to the recommendation of the Royal Commission on Local Taxation. In reply to a deputation of the Association in 1909, Mr. Lloyd George made two definite promises—namely, that he would devote a substantial portion of the next surplus to relieve the burdens of local authorities, and that he would hand to them one-half the proceeds of the land value duties. The Government had survived several years since that date; but these promises were still unfulfilled. A financial question that had come to the front recently was that of temporary loans required by local authorities to meet current expenditure. It seemed to be a question of considerable doubt whether, under the existing law, a local authority were entitled to resort to their bankers in the same way as private individuals, for the purpose of obtaining financial assistance to meet current expenditure that had to be incurred pending the receipt of the revenue to which it was ultimately charged. The difficulty was one that affected both municipalities and their bankers; and, consequently, negotiations had taken place between the Association and the Country Bankers' Association, for the introduction of a Bill to place this matter on a definite and satisfactory basis. The Bill had been settled to the satisfaction of both Associations, and had been discussed with the Local Government Board; and it was hoped that it would be introduced at an early date. As the Chairman of the Finance Committee of one of the largest cities, he knew full well, and the members of the Association all knew, that there was no subject which it was more important to keep constantly to the fore than that of the relations between the Imperial and local exchequers, so that a fair share of the expenditure in respect of national services might be defrayed out of the national purse.

The *agenda* was a lengthy one, and a number of different subjects were discussed. One of the resolutions was in the name of the Town Clerk of Bacup, who moved that the Law Committee be requested to consider and report on the state of the law as affected by recent decisions and the taking over of the telephones by the Government, in regard to the supply of water to post office premises. He explained that the reason for his motion was that the Postmaster-General had had a difference with his Corporation as to the basis of charge for the supply of water to the post office, which it was contended was a "dwelling-house" for this purpose. Decisions had confirmed this contention, within limits. In the case in question, workshops, &c., in connection with the telephone business had been constructed, which would use water for other than domestic purposes; and the Post Office maintained that they could so use the water, and still pay only the domestic rate. He ventured to suggest that such a contention was both absurd and unfair; and he wanted the Law Committee to see whether the local authorities could not get what they ought to obtain in the way of revenue from water supplies to post office premises. The Town Clerk of Lancaster seconded the resolution, which was unanimously agreed to.

Courteous Water Company.—A resident at Westcliff-on-Sea recently sent to the "Daily Mail" the following letter received from the Southend Water Company, and recommended it as a pattern: "Dear Sir,—I am duly in receipt of your favour of May 1, intimating that you will be leaving your house on May 29. As you have been good enough to pay the water-rate up to June 24 next, the sum of 5s. 5d. will have been overpaid by you; and if you will kindly sign and return the enclosed form to me, the amount will be remitted in due course. If you are leaving the district, it only remains for me to thank you, on behalf of the Company, for your custom in the past."

THE DISASTROUS EXPLOSION AT NOTTINGHAM.

Gas Generated by Electric Cables admitted to be the Cause.

An explosion which occurred some months ago at the Albert Hotel, Nottingham, resulting in great damage to the basement of the building and the partial demolition of rooms above, with consequent injuries also to several firemen and members of the staff of the hotel, has entailed upon the Corporation expense of a very substantial character.

The occurrence was variously attributed at the time to defects in the gas or electric lighting services—responsibility being denied in turn by each of the departments concerned. The liability has now been admitted to devolve upon the Electricity Department; the Committee, in a report which has just been adopted by the Council, confessing the view that the persons who had sustained damage had good claims against the Corporation—their judgment being based on the ground that the explosion was caused by a fire in the electric cables, the gases from which had found their way into the cellars and basement of the hotel and had become explosive. The Committee have compromised the claims for a total sum of £4791 15s. 9d., in addition to a life annuity of £52 for the Assistant-Manageress of the hotel, who was very seriously injured. The capital sums paid have been taken from the reserve fund of the electricity undertaking. It is fortunate that the financial position is one which enables the matter to be dealt with in this way without its effect being seriously felt.

The annual report which has been prepared within the last few days, shows that there has been an increasing demand in Nottingham for electricity for lighting as well as power purposes; the distributing mains having been extended in all directions. The number of units sold during the twelve months has been: For lighting, 3,803,553; for power, 2,734,570; for traction, 6,039,203—a total of 12,577,326 units, or an increase of 632,799 units. The average price obtained per unit was 1·82d., compared with 1·86d. last year; while the total working cost was 1·02d., contrasted with 1·04d. last year. The sale of current yielded £94,863, and a balance of £44,061 was carried to the net revenue account—£28,390 going in interest, repayment of loans, &c., £14,850 contribution to the rates, and £831 to the reserve fund. The Albert Hotel explosion has apparently emphasized the necessity of better ventilation of the mains; and to meet this, an elaborate system of ventilating boxes is at the present time being installed, at considerable cost, throughout the city.

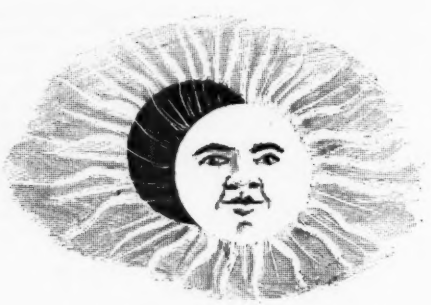
Earls Colne Water Supply.—A Local Government Board inquiry has recently been held relative to an application by the Halstead Rural District Council for sanction to borrow £400 for experimental boring, with a view to providing a public supply of water for Earls Colne. The scheme, which has been prepared by Messrs. Sands and Walker, allows for a daily supply of 42,000 gallons for a population of 2100; and the estimated cost is about £5000.

FATALITY AT THE BECKTON GAS-WORKS.

The Coroner for the county and borough of West Ham (Mr. Hilleary) held an inquiry, on Monday last week, relative to the death of Alfred James Joyce (64), a pump attendant at the Beckton Gas-Works. Mr. C. Beasley Robinson (Messrs. Monier-Williams, Robinson, and Milroy) appeared for the Gaslight and Coke Company; Mr. W. Williams, one of the Inspectors of Factories, represented the Home Office; and Mr. J. N. Reeson, the Engineer-in-Charge at Beckton, was in attendance. Sidney Henry Wood, Superintendent of Machinery, said the deceased had been in the Company's employ for forty years, and was a thoroughly reliable man. He had been engaged as pump attendant for thirty years; his work being to oil and grease the machinery, and see that there was a plentiful supply of water. The pump-house consisted of two lines of shafting and three cranks on each side. It was all fenced round with solid iron plates 3 ft. 6 in. high from the floor level, cased-in by iron hinged doors which could be easily raised. The attendant would lift one of the doors, stand on it, and then oil the machinery. The well was 10 ft. 8 in. deep. Witness said he could only imagine that while the deceased was oiling the shafting he stumbled and fell into the well. There was no possible chance of the attendant going over if he was careful, and opened the doors one at a time. There was sufficient room all round the pump for a man to stand. In answer to Mr. Robinson, witness said the men were each supplied with a can with a long spout, so as to avoid leaning over the machinery. Deceased was warned against oiling it while in motion; and it would be contrary to orders if he did so. James Henry Gray, brigade fireman and certificated for first aid, deposed that on the evening of Thursday, the 9th inst., he heard a scream, and ran to the well. The engine was at once stopped, and he went down the well and found the deceased lying quite clear of the motion of the pump and the shafting. Dr. Frank Milton, the House Surgeon at the Seamen's Hospital, said deceased was brought in suffering from a fractured spine, a lacerated wound on the thigh, and a scalp wound; and he expired shortly after his admission. The immediate cause of death was shock following on the fractured spine. The Coroner having summed up, the Foreman of the Jury said they were unanimously of opinion that the case was one of "Accidental death;" but they asked him to make a suggestion that, if possible, a rail should be put opposite the place where the deceased was standing, so that anybody could put his hands upon it to avoid slipping. The Coroner said he was sure the Company would do anything they could to prevent the recurrence of an accident; and the Factory Inspector would make any suggestion he thought possible.

Altheat Company, Limited, has been formed with a capital of £5000, in £1 shares, to carry on the business of manufacturers of gas and other stoves and apparatus, and to adopt an agreement with Mr. P. R. Wilde.

NO ECLIPSE OF THE "SUN."



There will be no eclipse of the "SUN," but very shortly there will be a **Shadow.**

A well-known firm are about to place on the market a Gas-heated Boiler for hot water supply, based on the principle so long maintained single-handed by Wright's famous "SUN" Boiler.

It will probably be known as the **"SHADOW."**

Public attention is cordially invited.

EXAMINATION IN "HEATING AND VENTILATION."

The City and Guilds of London Question Paper.

The subject of "Heating and Ventilation" has of late been added to the list of subjects on which examinations are held by the City and Guilds of London Institute; and as both branches are of interest to students of gas supply, we give the questions set at the recent examinations. Three hours were allowed for each paper; and the candidate was instructed not to attempt more than eight questions in either grade—at least three to be taken from each section. As in the case of the papers on the other subjects noticed in the "JOURNAL," the maximum number of marks obtainable is affixed to each question.

HONOURS GRADE.

Section A.

1. (*a*) What is the relation between the peripheral speed of a fan and the discharge pressure of the air? (*b*) Calculate the peripheral speed for a pressure of 2 inches of water, also the revolutions per minute for a fan 5 feet diameter. (*c*) Calculate from first principles the horse power absorbed by a fan of 63 per cent. efficiency in forcing 50,000 cubic feet of air per minute against a head of 1 inch water-gauge. [45.]

2. Calculate the volume per hour of air passing through a room under the following circumstances: Outside temperature, 38° Fahr. Capacity of room, 8560 cubic feet. Air supplied by an inlet flue 14 inches square and 15 feet high, delivering into the room 4 feet below the ceiling; the room being 14 feet high. At the bottom of the flue is fixed a battery of hot-water coils, having 120 square feet of heating surface and 165° Fahr. mean temperature. The room is also provided with an extract flue 14 inches square and 25 feet high, at the bottom of which three gas-jets are kept burning, consuming 18 cubic feet of gas per hour. In such a room, where would the level of the neutral zone be found? [30.]

3. State what you know of the methods of testing air for carbon dioxide, organic matter, and dust. How is an anemometer used to measure the velocity of an air current. [35.]

4. Explain the distribution of temperature in a hot-water radiator. State the meaning of the expression "mean temperature of a radiator." [30.]

5. [This was a question in which a figure was given indicating a two-pipe hot-water system; and the candidate had to determine the sizes of the mains and risers to supply the amount of heating surface shown, assuming that every square foot emitted 160 B.Th.U. per hour, that the temperature of the flow was 190° Fahr. and of the return 140° Fahr.; and 30 marks were allowed.]

6. A reading-room measures 75 ft. by 40 ft.; the height to the ridge being 25 feet and of side walls 15 feet. The roof area is 3840 square feet, the exposed wall area 2000 square feet, and of glass 600 square feet. The entrance, book-shelves, and serving counter are situated at one end only, under which is placed the heating chamber. Electric lamps are fitted. The room is to be warmed by low-pressure hot-water ventilating radiators and cast-iron piping; the latter passing between the legs of the radiators. The extraction is to be by two electric fans, one fixed in each gable.

(*a*) Calculate the heat losses of walls, glass, roof, and air, when the inside temperature is 60° Fahr. and the outside air 30° Fahr., allowing for four changes of air per hour. Use the following coefficients: Glass, 1·03; walls, 0·3; ceiling, 0·2; air, 0·02. Add 15 per cent. to compensate for other losses.

(*b*) Calculate the total heating surface required, assuming its average temperature to be 140° Fahr., and transmitting 1·5 B.Th.U. per square foot per hour. [35.]

Section B.

7. Design a low-pressure hot-water system suitable for the reading-room given in Question 6. Show by neat line diagrams the arrangement of the boiler, piping, radiators, expansion-tank, &c. Give approximate diameters of flow and return pipes, proportions of radiator and pipe surface fitted, and size of connections to radiators. [40.]

8. Describe and illustrate in detail the method usually employed for extracting locally and collecting the dust from emery wheels. Show the general arrangement of a complete system suitable for six pairs of wheels. What is the most suitable type of fan for dealing with very dusty air? [30.]

9. Describe and illustrate the general arrangement of the plant required for a vacuum system of steam heating; exhaust steam being utilized and supplemented as required by high-pressure steam. What is a thermostatic valve? [40.]

10. Describe and sketch in some detail the method of heating and ventilating a large modern theatre on the plenum principle. Show the apparatus required for tempering, filtering, heating, and distributing the air. [45.]

11. Sketch and describe the general lay-out of the plant required for a forced hot-water circulating system; comprising steam-pump, steam-heated calorifier, &c. Show clearly how the pipes and valves are arranged. [35.]

12. Draw and explain the general arrangement of a system of ventilating, humidifying, and heating a weaving-shed or large workroom. [30.]

ORDINARY GRADE.

Section A.

1. (*a*) State the composition of normal fresh air and expired air. (*b*) By what natural agencies and forces is the external air or atmosphere purified and kept of normal composition? (*c*) What are the common evidences and effects of bad ventilation? [30.]

2. Explain briefly and clearly the following terms: Diffusion, radia-

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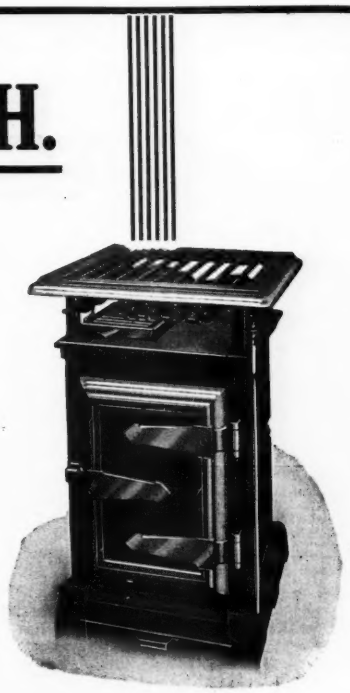

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tion, conduction, convection, degree (Fah. and Cent.), absolute temperature, British thermal unit, French thermal unit or calorie, specific heat, absolute pressure, gauge pressure, 2 inches water pressure. [35.]

3. Explain what is meant by the draught in a chimney or hot-air flue. By what means is it measured?

If h feet = height of chimney,
P lb. per square foot = pressure or intensity of draught,
W lb. per cubic foot = weight of external air,
w lb. per cubic foot = weight of heated gases,
then $P = h\,(W - w)$.

Using this formula, calculate the intensity of draught, both in pounds per square foot and inches of water, when the flue gases of a heating-boiler have an average temperature of 300° Fahr. and the external temperature is 50° Fahr.; given that a cubic foot of air weighs 0·0522 lb. at 300° and 0·0772 lb. at 50°, also that 1 oz. pressure per square inch is equal to a water column 1·73 inches high. Assume a height of 100 feet. [30.]

4. A fan delivers 1000 cubic feet of air per minute through a battery of steam-coils. The air enters the battery at a temperature of 50° Fahr. and leaves it at 140° Fahr. Assuming that every cubic foot of the entering air weighs 0·078 lb.—

(*a*) Calculate the number of heat units absorbed by the air per minute and per hour; the specific heat of air being 0·238.

(*b*) Calculate how many pounds of steam must be supplied per hour to the coils, taking the effective heating value per pound to be 1020 B.Th.U. [30.]

5. A hot-water heating-boiler serves 1000 square feet of heating surface. The temperature of the water leaving the boiler is 180° Fahr., and that of the return to the boiler 140° Fahr. Assuming that every square foot of surface transmits 150 B.Th.U. per hour—

(*a*) Calculate how many pounds of water must be heated and circulated through the pipes per hour and per minute.

(*b*) Calculate the velocity in feet per minute of the water through the flow and return mains, which are 4 inches diameter. Assume that a pound of water measures 28 cubic inches. [30.]

Section B.

6. (*a*) Show, by neat sketches, all the usual methods of jointing wrought-iron pipes, and compare their merits. (*b*) When should galvanized pipes be used? Describe the process of galvanizing. (*c*) State what precautions are necessary in erecting flow and return mains, branches, T pieces, risers, &c., to ensure an efficient circulation of hot water or steam through them. [45.]

7. (*a*) Sketch in vertical and horizontal sections a six-column cast-iron radiator, showing in detail how the sections are jointed together. What fittings are necessary for water and for steam? (*b*) A ventilating radiator, provided with detachable front baffle-plates, stands in front of a fresh-air inlet in a window recess. Sketch the arrangement in vertical section. Show clearly how the admission of air is regulated. What are the advantages of ventilating radiators? [40.]

8. (*a*) State the advantages and drawbacks of the hot-air system of heating a church. (*b*) Sketch in section and fully describe the action of an air-heating furnace, and clearly show the connections. (*c*) Sketch in outline a full-housed top horizontal discharge blower fan; also a similar fan designed for double discharge. [45.]

9. Describe, with the aid of neat sketches, the construction and action of an automatic damper regulator for a hot-water heating-boiler, and show how it is connected up. What is the function of a damper regulator. [35.]

10. Draw neat line diagrams showing the general arrangement or lay-out of a one-pipe and of a two-pipe system of hot-water heating as applied to a residence. The boiler is placed in the basement, and serves radiators fitted on the ground and first floors. Show the position of the expansion-tank and the method of air-venting the system. [40.]

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Edinburgh.

On Saturday, the members of the Eastern District of the Scottish Junior Gas Association will have a regular field day at Perth. The occasion is the quarterly meeting; and an interesting programme of business has been arranged. Mr. David Vass, Engineer and Manager of the Perth Gas-Works, is to give an address on gas matters generally; Mr. Scott, of Granton, will submit a communication on "Carbonization in Bulk;" and there will be a general discussion on coal reserves in gas-works. The gathering will take place in the lecture-room of the Museum; and the hope is expressed that there will be, now that the train services are back to the old ways, a large turn-out of members.

Among the registrations of joint stock companies in Edinburgh during last week is the Glasgow Night Guards, for the purpose of organizing a system for the guarding and night watching of warehouses, shops, &c., against the danger, among other things, of water and gas. The capital, for which the public are not invited to subscribe, is £5000, in £1 shares.

Another registration is the Carfin, Newarthill, Cleland, and Districts Gas Company. The Company has been formed to acquire the Carfin Gas-Works; and the capital is £15,000, in £1 shares.

In the Court of Session on Tuesday, Lord Hunter ordered the issues for the trial of the action by Mrs. Agnes Boyd or Brown, of No. 1, St. Bernard's Place, Edinburgh, against Messrs. Jack and Renwick, of Edinburgh, for £800 damages—being £500 for herself and £100 each for her three children, in respect of the death of her husband George Brown, who was a cabman in the employment of the defenders. It is alleged that the deceased, on Nov. 19 last, was hanging up a set of harness when his clothes were set on fire by the gas-jets at the foot of a radiator which heated the place. He sustained injuries that caused

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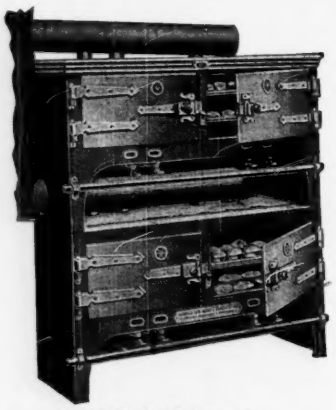

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death. Fault is denied by the defenders, who say that the deceased, while wearing an apron which was saturated with oil, leaned over the radiator. They also deny that the radiator was faulty, or that complaints had been made regarding it. Liability under the Workmen's Compensation Act to the extent of £175 10s. is admitted.

Lord Dewar, in the Court of Session on Tuesday, sent to the Procedure Roll the action by Sir Charles Elphinstone Adam, Bart., of Blairadam, against the Town Council of Lochgelly, which seeks to have the respondents interdicted from sinking a bore or bores for the purpose of adding to the water supply, upon ground forming part of his estate at Lochornie, interim interdict against which was granted some time ago in the Bill Chamber.

About 120 out of 140 master plumbers in Edinburgh and Leith combined for mutual protection. One of the rules provides that all the members of the Association shall pay a commission into the Association's funds of from 2½ to 5 per cent. on all contracts, one-third of which shall be retained by the Association, and the remaining two-thirds shall be divided among the unsuccessful offerers.

Aberdeen.—Tuesday night saw the close of an extremely successful course of lectures and demonstrations on cooking by gas promoted by the Gas Committee of the Aberdeen Town Council. A gratifying number of orders have resulted from the lectures. Reference was made to the services rendered by Mr. Samuel Milne, the Gas Engineer, and his staff, and a hearty vote of thanks accorded to the lecturer, Miss Ferguson.

Arbroath.—At a meeting of the Arbroath Gas-Works Committee, the Manager referred to the position of the Corporation during the recent coal miners' strike, which had not caused serious inconvenience at the gas-works, though when the strike ended the stock of coals was nearing exhaustion. He stated that coal was now coming in from the collieries. The Committee agreed to keep a larger stock than had been hitherto done. The Gas Manager drew attention to the question of discounts, and the claim which had been made by two consumers that the gas account for their house supply should be combined with the account for their business premises, so that they might obtain the discount corresponding with the total of the two accounts. After consideration, it was agreed that the parties who had claimed the discount on the aggregate of their consumption for dwelling-house and business premises should have it, but that further consideration should be given to this question when the price of gas for the current year was fixed.

Denny.—At the Town Council meeting on Tuesday evening, Mr. John M'Donald, the Gas Manager, stated that the meter survey in the new district had been finished, and only a part of the prepayment meters were yet to be taken out in the burgh to complete the district. A number of cookers and grillers were still required. In the new district 110 grillers and 12 cookers had been fitted up.

Hamilton.—At the Town Council meeting on Tuesday evening, the Gas Committee reported that the average illuminating power was 15·54 standard candles. The reduction in the candle power was accounted for through deterioration in the coal while in the store.

Kilmarnock.—The Town Council have agreed to lend small gas-cookers to the ratepayers free of charge, while continuing to charge an annual rent of 2s. 8d. or 3s. 2d., according to size, for large stoves. This concession to the ratepayers entails a capital expenditure of £1000. The rate for gas is 2s. 3½d. per 1000 cubic feet.

Lockerbie.—The Town Council have agreed to reduce the price of gas for lighting purposes from 5s. to 4s. 7d. per 1000 cubic feet. The charge for motive power and cooking purposes remains at 4s. 2d.

Rattray.—At the Town Council meeting on Tuesday, the Gas Company's account for £58 19s. 7d. (about £2 more than last year) for gas for street-lamps, showed that, owing to breakages, incandescent street lighting is proving rather costly,

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Claim for Damage Caused by a Burst Water-Main.

At the Shoreditch County Court, last Thursday, before his Honour Judge Cluer, Mr. James Thomson, a publican, of 7, Wallis Road, Hackney Wick, sued the Metropolitan Water Board to recover £11 15s. 10d. in respect of damage done to beer in his cellar by flooding, owing to the bursting of a water-main. Mr. J. W. Ross Brown appeared for the defendants. The burst occurred on the 5th of February, and plaintiff informed the Board's officials of it; but nobody was sent to attend to the matter. The water was gushing into the cellar all day. His Honour said this bare statement was not sufficient. The plaintiff must call someone who would speak as to the cause of the burst; otherwise there was no case to answer. Plaintiff said he thought the main was rotten. His Honour said plaintiff would have to prove this, and also that the Board had knowledge of it. One of the defendants' men was called, and stated that he considered the main had burst in consequence of the frost, which was very severe at the time. Their men were busy attending to bursts in all directions from this cause. His Honour remarked that in the case of frost the Board were not liable. Witness added that the main was about 3 ft. 6 in. below the pavement. This being so, said his Honour, it was very unlikely that the frost would cause a burst. But even if the pipe was defective, the plaintiff had to prove that the Board knew it to be in this condition. There was no case; and judgment would be for the defendants, with costs.

The recent advances in wages granted to Salford Corporation gas-workers, and reduction in the hours of labour conceded by the Gas Committee, represent an additional annual charge to the department of £1854. Alderman J. Snape, who supplies the information, also states that this, together with the liability of the Corporation under the Insurance Act, the increase in the minimum wage of Corporation employees, and increased police pay, will require an extra rate of 2d. in the pound.

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LEST YE FORGET.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 18.

Sulphate of Ammonia.

Notwithstanding the fact that direct buyers abroad remain apathetic, and that the season for home consumption is practically at an end, the requirements by middlemen for the fulfilment of May shipments have proved sufficient to prevent a further decline in values, and even to bring about a slight improvement in the latter half of the week. The quotations at the close are £14 13s. 9d. to £14 15s. per ton f.o.b. Hull, £14 15s. to £14 16s. 3d. per ton f.o.b. Liverpool, and £14 16s. 3d. to £14 17s. 6d. per ton f.o.b. Leith. The forward position has become rather neglected again; but producers continue firm in their ideas at £14 10s. per ton f.o.b. good ports for delivery, either July-December this year or January-June next year.

Nitrate of Soda.

There is no change in either tone or value, and holders are still quoting 11s. 1½d. per cwt. for ordinary and 11s. 3d. for refined quality, on spot.

LONDON, *May* 20.

Tar Products.

There is little alteration in the markets for tar products; but on the whole prices are decidedly firm. Pitch is in good demand for near and forward delivery. Benzols are steady, and business is difficult to negotiate. Solvent and heavy naphthas are in good demand, and prices remain firm. Creosote is firm, and maintains its price; and there is a fair amount of inquiry for prompt and forward delivery. Crude carbolic continues about the same, and business is reported for forward delivery.

The average values during the week were: Tar, 28s. to 32s. *ex* works. Pitch, London, 53s. to 54s. 6d.; east coast, 52s. 6d. to 54s.; west coast, Clyde 53s. 6d. to 54s. 6d., Manchester 51s. 6d. to 53s. 6d., Liverpool 52s. 6d. to 53s. 6d. Benzol, 90 per cent., naked, London, 11d. to 11½d.; North, 11d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10d. to 10½d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3⅞d. to 4½d. Solvent naphtha, naked, London, 1s. 0½d. to 1s. 1d. f.o.b.; North, 11d. to 11½d. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅝d. to 3⅛d.; North, salty, 2½d. to 2⅝d.; liquid, 2⅝d. to 2¾d. Heavy oils, in bulk, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 4d. to 2s. 5d. Naphthalene, £4 10s. to £9; salts, 45s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been a little more inquiry for this during the past week, especially for prompt and near delivery; and this has been the means of keeping the market extremely steady. Beckton to-day is quoted £14 5s. Outside London makes are £13 18s. 9d. Leith, £15; Liverpool, £14 18s. 9d.; Hull, £14 17s. 6d.; Middlesbrough, £14 17s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a fair demand for coal, but steamers have been scarce, so that the shipments are only moderate; and this, with a full production, has made the prices easier. For best Northumbrian steam, about 14s. to 14s. 3d. per ton f.o.b. is quoted; second-class steams are 12s. 6d. to 13s.; and steam smalls from 9s. 9d. to 10s., the latter being relatively in better inquiry. In the gas coal trade, the demand is good for the season; but the shipments are hindered by the cause mentioned above. Best Durhams are 14s. 3d. per ton f.o.b.; and second-class are about 13s. "Wear specials" are quoted at about 15s. per ton f.o.b. The tenders for coal for the Stockholm Gas-Works have been sent in, and the decision is expected soon. It is quite certain that the prices will be considerably above those that ruled in the past year. There are also one or two other smaller contracts for gas coals in the market; but there is some doubt as to whether prices have touched the lowest. The settlement of the minima for miners' wages will help towards a decision; and the market is slightly firmer since this was made known. Coke is steady. Gas coke is now in smaller output; but the retail demand at the works is less. Good quality is now quoted at 15s. per ton at Newcastle; but for shipment the prices are higher.

Scotch Coal Trade.

During the week, business in the Scotch coal trade has not been of comparatively great volume; and the sharp rise in freights is accountable for fewer fixtures. On Saturday, the quotations f.o.b. Glasgow were: Steam coal, 11s. 6d. to 12s.; splint, 12s. to 13s.; ell 11s. to 12s.; trebles, 11s. 6d. to 12s.; doubles, 11s. 6d. to 12s.; and singles, 12s.

The Agitation among London Gas Workers.—Emphatic protests against what the speakers described as the "Americanized" method of "speeding-up" introduced in London gas-works, were made at a demonstration, arranged by the National Union of Gas Workers and General Labourers, outside Battersea Park last Sunday morning. Mr. W. C. Rolfe, who presided, denounced the co-partnership system, which he described as "so much swank." It did not, he said, prevent a gas worker from "getting the sack." Councillor Jack Jones, of West Ham, said that if at the next strike the Trade Unions went to the banks and drew out all their money, they would paralyze the whole "jiggery-pokery" of capitalism. If they were to have anything to say in the fixing of their conditions of work, they must become the political and industrial masters of their own rights.

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Oswaldtwistle Gas Supply.

A very satisfactory report on the working of the gas undertaking of the Oswaldtwistle Urban District Council during the past fianancial year was recently presented to the Gas Committee by the Engineer and Manager (Mr. J. H. Davies). The quantity of gas sent out was 72,950,000 cubic feet—an increase of 5,890,000 cubic feet on the output in 1910-11. The revenue for the year was £12,457, and the expenditure £6934; the gross profits being £5523, and the net profits £3034—increases of £822 and £161 respectively. The additional profits were realized despite the fact that last year an additional £820 had to be produced in order to make the same net profit as in the previous year because of extra charges for sinking fund, interest, income-tax, &c. Out of the profits, £1000 will be used in relief of the rates. Owing to having made last year favourable contracts for coal up till March, 1913, the Gas Committee entered upon the period of the recent strike with twelve months' supply. They were thus able to render considerable assistance to manufacturers, and incidentally to workpeople, and at the same time save the loss that would otherwise have been incurred on account of the enhanced price. The quantity of coal sold was 241 tons; and the net profit was £145. During the strike period, the Committee sold coke at considerably less than its market value; and if they had advanced the price to the same degree as other manufacturers, a further profit of £231 could have been realized.

Shepshed Gas-Works Results.—The results of the working of the Shepshed Urban District Council gas undertaking for the past year are reported to be very satisfactory. Receipts from the sale of gas show (at £1649) an increase of £29 over the previous year, in spite of the fact that there was in operation over the whole of the twelve months a reduction in price of 5d. per 1000 cubic feet on ordinary meter consumption, and 3d. on slot meters. The gross profit for the year is £744, which is sufficient to provide for all charges and leave a substantial balance to carry forward. The Council passed a vote of thanks to the Manager (Mr. J. E. Matlock) and the Clerk (Mr. M. Smith).

Potteries Water Bill and the Corporation.—A special meeting of the Stoke-on-Trent Federated Council was held last Thursday, by requisition, to discuss certain minutes of the Water Committee and to consider a notice of motion proposing in effect to rescind former resolutions accepting the concessions of the Staffordshire Potteries Water-Works Company and to revert to the original petition in opposition to the Bill. Early in the proceedings, the Mayor intimated that he had felt so concerned as to the position of the Corporation and his own responsibility in the matter, that he had taken the opinion of Mr. J. D. Fitzgerald, K.C., who had advised that, if resolutions which had already been acted upon were rescinded by the Council, their rescission would have no effect. Counsel also advised the Mayor that he should rule the resolution out of order, so far as it proposed to rescind motions already acted upon. The matter was, however, subject to this ruling, pressed to a division; and the motion was carried by 35 votes to 29.

Chorley Gas Surplus.

The proposal of the Chorley Corporation Gas Committee to allocate £2468, the surplus on last year's working of the undertaking, for the relief of rates, led to some discussion at a recent special meeting of the Town Council. In moving the adoption of the minutes of the Gas Committee, the Chairman (Alderman J. Sharples) stated that during the year the make of gas was 171,000,000 cubic feet, compared with 158,000,000 feet in the preceding year, an increase of 13,000,000 feet. The £2468 which they were handing over in aid of the rates was an increase of £1425 over the sum given last year. The question of reducing the price of gas would be considered at a meeting of the Committee next month, so that the reduction could take effect as from July 1. By that time, they would have a definite idea as to what coal was to cost them for the year. Mr. Sandham opposed the resolution of the Gas Committee to hand over £2468 in relief of rates, as he did not believe in the utilization of gas profits for this purpose. It was unfair, in his opinion, to charge gas consumers in the town a price that was unreasonable, a proof of which was found in the substantial profit of £2468 that had been made on the undertaking. Having regard to the thousands of pounds which had been taken from gas profits year by year, he thought the time had arrived when they ought to run a profit and loss account more finely than in the past, to enable a substantial reduction in the price of gas to be made at the earliest possible moment. He also took objection to the Committee's decision to purchase a coke-washing machine, at an estimated cost of £560, such amount to be defrayed out of the depreciation fund—arguing that the business-like course was to pay for the machine out of revenue account or capitalize it. To take the money for a new machine out of the depreciation fund was wrong in principle; and he moved that the minutes of the Gas Committee be referred back for further consideration. There was no seconder, however, and the minutes of the Gas Committee were eventually confirmed in their entirety.

As an example of the salubrity of gas-works, we are informed that at the present time, at the Pitlochry works, a blackbird can be seen feeding its young in the retort-house; and that this is the second nest of the season. A blackbird has now had its summer quarters in these works for a good number of years in succession. A thrush has also built its nest in the workshops of the same works, and is rearing its young there.

Two neatly got-up price lists of the Company's various gas-heating devices have been received from the Richmond Gas Stove and Meter Company. One is devoted exclusively to their "New Model," "Bungalow," and "New Crusader" cookers; while the other is more comprehensive, and embraces a variety of gas-heating devices, both for household and industrial use, supplied by the Company. The general list contains some hints on the management of cookers; while in both, under the heading of "Gas *versus* Electricity," the superiority of gas over electricity for cooking is strikingly set out.

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BIRMINGHAM & LONDON.

Stewarts and Lloyds, Limited.—The Directors have decided to pay an interim dividend of 6d. per share, tax free, on the deferred shares in respect of the half year to June 30, so that the existing shares may receive dividend to the date when the 212,500 new shares begin to rank. The deferred share capital will then stand at £425,000.

Monte Video Gas Company.—According to the report of the Directors of this Company for the year ended Dec. 31 last, the profits amounted to £27,429. Adding interest and discount, profit on exchange, Directors' fees waived (£280), and the balance of £12,338 brought forward, there is a total of £42,038. After providing for interest on the debenture stock, income-tax, bad and doubtful debts, and depreciation, and placing £3000 to the renewal account, the balance remaining at the credit of the profit and loss account available for distribution is £31,463. The Directors recommend the payment of a further amount of 8s. per share, less tax, making 3½ per cent. for the year—leaving £12,496 to be carried forward. The sales of gas in connection with cookers, geysers, and for industrial purposes show a satisfactory increase.

Reduction in Price at Sutton-in-Ashfield.—Sutton-in-Ashfield, one of the most rapidly growing centres in the Mansfield district of Nottinghamshire, has achieved substantial results in connection with its gas undertaking, which is in the hands of the Urban District Council; the town's situation in the midst of a rich coalfield being necessarily of substantial advantage. At the last meeting of the Council, it was decided to make considerable reductions in prices, it being explained that, after these had been effected, there would still be a satisfactory margin for contingencies. The reductions, which have been rendered possible by the increase in the gas profits last year will bring down the prices to 3s. 1d., 2s. 11d., and 2s. 10d. per 1000 cubic feet; and the slot-meter consumers are to receive 4½d. instead of 3d. discount in 2s. A reduction of 3d. is also to be granted to consumers in Skegby.

Extensions at the Widnes Gas-Works.—The Widnes Town Council have instructed the Gas Engineer (Mr. Isaac Carr) to prepare plans and estimates for certain reconstruction works rendered necessary by the increasing demand for gas and the need for larger coal-stores. Emphasizing the latter requirement, the Engineer remarks, in his report, that one of the lessons of the recent coal miners' strike, from a gas-works point of view, is the provision of much greater coal storage than is at present available.

APPLICATIONS FOR LETTERS PATENT.

10,675.—GREEN, W. J., "Clockwork igniter." May 6.
10,755.—BUSH, J., "Inverted burners." May 7.
10,793.—WEYMAN, G., and HARDIE, T., "Chemical process for the manufacture of a material consisting chiefly of oxides, hydroxides, sulphides, and other compounds of iron for gas purification. May 7.
10,815.—BENNEFELD, C., "Gas-lamp." May 7.
10,824.—SIEMENS, F. K., "Regenerative-gas furnaces." May 7.
10,836.—GAYFORD, C., "Burner for gas-fires." May 7.
10,965.—HUME, G. W., "Gas-controllers." May 8.
10,979.—HELLER, E., "Regenerators." May 8.
11,103.—SPARKS, E., "Incandescent burners." May 10.
11,127.—SHARP, A., "Gas-engines." May 10.
11,209.—DEMPSTER, R., AND SONS, LTD., and TOOGOOD, H. J., "Utilizing the residual heat of coke produced in vertical retorts." May 11.
11,210.—DEMPSTER, R., AND SONS, LTD., and TOOGOOD, H. J., "Discharging vertical retorts." May 11.

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange has had another disappointing week. The last hebdomadal period was not calculated to inspire enthusiasm; but last week things went from bad to worse. All the chief markets were depressed; and only in the minor lines did a ray of light flicker up now and then. Hard money and politics at home and abroad darkened the Consols and gilt-edged market, Railways were perturbed by the new Bill and labour questions, and Americans were very uneasy. The announcements of four failures were another weight in the scale. Still people talk of better things coming after the holidays—which is courageous. The opening on Monday was quiet enough for fresh business, thought being had to the settlement of the account. The tone was rather poor. Consols did not move; but Rails were rather easier. Tuesday produced no improvement in the general tendency, and Government issues weakened. Railway prices were lower all round, and Americans were jumpy—falls prevailing. Wednesday was variable. The squeezing-out of weak "bulls" resulted in three failures. Gilt-edged were depressed; Consols receding ⅛ for money and ¼ for the account. Rails, however, cheered up a bit. Thursday was quieter, partly owing to a Continental holiday. Government issues were still poorly, and Consols went down another ⅛; but Rails again were in a happier mood. On Friday came another failure; and the general tone was depressed. Consols fell another ⅛, for money and the account; and Rails were offered without much response from buyers. Americans were lower all round. Saturday gave a dull termination to a dull week. Government issues were heavy, and Rails continued weak. Consols closed at 77⅜ to 78—a fall of ⅜ in the week. The Money Market was firm; rates both for short loans and for discount steadily stiffening. Business in the Gas Market was a fair average, though scarcely up to the level of the week before. There was nothing to complain of in the tone, for all changes, though slight, were in the upward direction; but the leading companies were not among them. In Gaslight and Coke issues, the ordinary was fairly active and steady, transactions ranging from 104½ to 105⅛. The secured issues were quiet; the maximum marking 85½ and 86, and the debenture from 78⅛ to 80. South Metropolitan was quieter, and was firm at prices ranging from 120 to 122. The debenture marked 80. In Commercials, there was one bargain in the 4 per cents. at 110, and one in the debenture at 76⅛. Among the Suburban and Provincial group, Alliance and Dublin changed hands at 77, ditto debenture at 92 and 92¼, British at 45, Brentford new at 199, Bournemouth old at 29⅛ and 29¼, ditto "B" at 16, Brighton original at 217 and 219, Ilford debenture at 94 (a rise of 1), and Wandsworth at 141½. In the Continental companies, Imperial marked 193 *cum div.* and from 187 to 189 *ex div.*, Union 85, and European 20⅝. Among the undertakings of the remoter world, Bombay realized 6¼ and 6⅜, Monte Video 12¼ and 12 6/16, Primitiva from 7⅛ *ex div.* to 7⅝ *cum div.*, ditto preference from 5¼ to 5 7/16, River Plate debenture 95 and 96½, and San Paulo debenture 50½.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	77—80	..	6 5 0
374,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Apl. 12	7½	Bombay, Ltd.	6—6½	..	5 15 5
50,000	10	Feb. 29	15	Bourne- mouth Gas & Water Pref. 6 p.c.	28½—29½	..	5 1 8
332,000	10	,,	7		16—16½	..	4 4 10
75,000	10	,,	6		14—14½	..	4 2 9
880,000	Stk.	,,	13	Brentford Consolidated	258—263	..	4 18 10
330,000	,,	,,	10	Do. New	195—200	..	5 0 0
50,300	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	,,	,,	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Mar. 28	12½	British	44½—45½	..	5 9 11
120,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
109,000	,,	Feb. 15	6	Bromley, A 5 p.c.	128—133	..	4 10 3
165,700	,,	,,	4½	Do. B 5½ p.c.	98—101	..	4 9 1
82,278	,,	,,	5½	Do. C 5 p.c.	117—120	..	4 11 8
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	108—110	..	4 19 4
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	,,	4	Continental Union, Ltd.	83—86	+1	4 13 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—138	..	5 1 5
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	19½—20½	..	4 17 7
16,160,600	Stk.	Feb. 15	4/14/8	Gas-light & Coke 4 p.c. Ord.	104½—105½	..	4 9 9
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	84½—86½	..	4 0 11
4,062,235	,,	,,	4	and Coke 4 p.c. Con. Pref.	102—104	..	3 16 11
4,531,705	,,	Dec. 14	3	3 p.c. Con. Deb.	78—80	..	3 15 0
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3½ p.c.	93—95	..	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	16½—17	..	6 9 5
131,000	Stk.	Mar. 14	7½	Ilford A and C	152—154	..	4 17 5
65,780	,,	,,	6	Do. B	123—125	..	4 16 0
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	93—95	+1	4 4 3
4,940,000	Stk.	May 15	9	Imperial Continental	186—189*	+½	4 15 3
1,235,000	Stk.	Feb. 15	3½	Do. 3½ p.c. Deb. Red.	88—90	..	3 17 9
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	219½—221½	..	4 10 3
718,100	,,	,,	7	Do. B.	159—161	..	4 6 11
306,083	,,	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4⅜—5	..	6 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101—103	+1	4 7 5
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	Feb. 15	4⅜	Newc'tle&G'tesh'd Con.	99—101	..	4 6 8
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	86—88	..	3 19 7
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	May 15	8	Oriental, Ltd.	134—136*	+½	5 17 8
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7⅛	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	137—140	..	4 18 4
60,000	50	,,	13	Do. B	130—133	..	4 17 9
100,000	50	,,	12	Do. C	127—130	..	4 12 4
398,490	5	May 15	8	Primitiva Ord.	7⅛—7⅜*	..	5 8 6
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
250,000	5	Apl. 12	12	San Paulo, Ltd.	11⅛—11⅜	..	5 2 2
115,000	10	,,	6	Do. 6 p.c. Pref.	11⅜—12¼	..	4 18 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	235—237	..	4 4 5
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,500	,,	,,	10	Do. C	234—236	+½	4 4 9
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	119—122	..	4 9 6
1,895,445	,,	Jan. 12	8	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,820	Stk.	Feb. 29	8½	South Shields Con. Stk.	156—158	..	5 7 7
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	122—124	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	Jan. 12	5	Do. 5 p.c. Deb. Stk.	119—121	..	4 2 8
562,310	Stk.	May 15	5	Southampton Ord.	105—107*	+½	4 13 6
120,000	Stk.	Feb. 15	7½	Tottenham A 5 p.c.	144—147	..	4 17 0
483,940	,,	,,	5⅝	and B 3½ p.c.	114—116	..	4 17 0
149,470	,,	Dec. 29	4	Edmonton 4 p.c. Deb.	96—98	..	4 1 8
132,380	10	,,	5	Tuscan, Ltd.	8⅜—8⅝	..	5 12 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	,,	6⅝	Wands- B 3½ p.c.	141—144	..	4 15 6
85,766	,,	Dec. 29	3	worth 3 p.c. Deb. Stk.	71½—73½	..	4 1 8

Prices Marked * are "Ex Div."

Under the title of "Rushmore Lamps," a Company has been formed with a capital of £20,000, in 7500 cumulative 6 per cent. preference shares and 12,500 ordinary shares of £1 each, to take over the business carried on by a Company of the same name as manufacturers of, and dealers in, searchlights, lamps, and all kinds of electric, gas, acetylene, and other illuminating apparatus.

A Special Sub-Committee of the Huddersfield Town Council recommended that a Committee composed of representatives of the Gas, Electricity, and Tramways Committees be appointed to purchase coal for all the departments of the Corporation; but the General Purposes Committee decided not to adopt the recommendation. At the last meeting of the Town Council, however, a Labour member unsuccessfully moved that the Committee be appointed. Alderman Taylor, in opposing, said that the total coal consumption of the Corporation was nearly 100,000 tons; and each of the large coal-purchasing departments was quite able to make good contracts to suit its purposes and to ensure regular supplies. Alderman Jessop (the Chairman of the Gas Committee) remarked that if the proposal were carried it would be followed by an attempt to get a municipal coal supply; and he had never heard of a municipal coal supply which had been successful.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ASSISTANT WORKS MANAGER No. 5569.
DRAUGHTSMAN. No. 5572.
DRAUGHTSMAN. Bath Gas Company.
DRAUGHTSMAN. No. 5560.
REPRESENTATIVE (METERS.) No. 5573.
CORRESPONDENT (H.-P. LIGHTING). No. 5568.
COAL SALESMAN. No. 5576.
GENERAL FOREMAN. No. 5575.
ENGINE FITTER (Charge of Machinery). Devonport Gas Department. Applications by May 25.

Appointments, &c., Wanted.

ASSISTANT-MANAGER. No. 5574.
RESPONSIBLE POSITION BY MECHANICAL ENGINEER. No. 5571.
SULPHATE PLANT MAKER AND REPAIRER. Leadburner. 15, Martin Street, Stratford.

Representation (Central Europe) Wanted.

SEWAGE CLARIFICATION. M.K. 5615, bef. Rudolf Mosse, Munich.

Patent Licence, &c.

OBTAINING GAS FROM TAR. H. Gardner and Son, 173-5, Fleet Street, E.C.
WASHING AND COOLING GAS. Cruikshank and Fairweather, 66, Chancery Lane, W.C.

Plant, &c. (Second-Hand), for Sale.

PURIFIERS, WASHER AND ENGINE, &c., AND TOWER SCRUBBER. Cambridge Gas Company.
PURIFIERS, STATION METERS, &c. Brighouse Corporation.
VALVES (FOUR-WAY). Cowes Gas Department.

Plant, &c. (Second-Hand), Wanted.

WASHER-SCRUBBER. Stanley Gas Company.
GAS METER (100,000 C. F. PER HOUR). No. 5570.
SULPHATE PLANT. No. 5577.

Stocks and Shares for Sale.

ASCOT GAS AND ELECTRICITY COMPANY. London Mart. June 4.
BARNET GAS AND WATER CO. London Mart. June 4.
BRIXHAM GAS COMPANY. London Mart. June 4.
BROMLEY AND CRAYS GAS CO. London Mart. June 4.
CROYDON GAS COMPANY. London Mart. June 4.
EAST HULL GAS COMPANY. By Tender. May 28.
HUNGERFORD GAS COMPANY. London Mart. June 4.
MITCHAM & WIMBLEDON GAS CO. London Mart. June 4.
PORTSMOUTH WATER COMPANY. Cooper's Sale Rooms, 14, Osborne Road, Southsea. June 4.
SOHAM GAS COMPANY. London Mart. June 4.
WHITCHURCH GAS COMPANY. London Mart. June 4.

TENDERS FOR

Benzol.

STOKE-ON-TRENT GAS DEPARTMENT. Tenders by June 13.

Brass Fittings, Lamp Columns, &c.

STOKE-ON-TRENT GAS DEPARTMENT. Tenders by June 13.

Coal and Cannel.

BRECON GAS COMPANY. Tenders by May 29.
DENBIGH GAS AND WATER COMPANIES AND RUTHIN GAS COMPANY. Tenders by June 1.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by May 27.
GAINSBOROUGH GAS DEPARTMENT. Tenders by May 27.
INVERNESS GAS DEPARTMENT. Tenders by May 27.
LOUTH GASLIGHT COMPANY. Tenders by June 1.
PEMBROKE DOCKS, &c., GAS CO. Tenders by May 28.
SEDGLEY URBAN DISTRICT COUNCIL. Tenders by June 7.

Condensers.

BURNLEY GAS DEPARTMENT. Tenders by May 29.

General Stores (Sulphuric Acid, Lime, Oils and Drysaltery, Ironmongery, Iron and Steel, Glass, Lead.)

EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by May 27.
INVERNESS GAS DEPARTMENT. Tenders by May 27.
LOUGHBOROUGH GAS DEPARTMENT.
STOKE-ON-TRENT GAS DEPARTMENT. Tenders by June 13.

Oil for Gas Making.

EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by May 27.

Pipes (Wrought and Cast), &c.

STOKE-ON-TRENT GAS DEPARTMENT. Tenders by June 13.
SUTTON (SURREY) GAS COMPANY. Tenders by June 3.

Scrubber-Washer.

LEEK GAS DEPARTMENT. Tenders by May 31.

Tar and Liquor.

BUXTON GAS DEPARTMENT. Tenders by June 3.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by May 27.
GAINSBOROUGH GAS DEPARTMENT. Tenders by May 27.
LEEK GAS DEPARTMENT. Tenders by May 31.
LOUGHBOROUGH GAS DEPARTMENT. Tenders by June 7.
OLDHAM GAS DEPARTMENT. Tenders by June 18.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

WHITSUNTIDE HOLIDAY.

In consequence of the WHITSUNTIDE HOLIDAY, Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than the FIRST POST ON SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, April 2, p. 7.

ENQUIRIES SOLICITED.

FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS,
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Telephone: 1588 AVENUE (3 lines).

TAR WANTED.
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Albert Chemical Works, BRADFORD,
MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every Description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, ROSE MOUNT IRONWORKS, ELLAND.

HUTCHINSON BROTHERS, Ltd., FALCON WORKS, BARNSLEY, MANUFACTURERS OF GAS METERS (ordinary and prepayment). MAIN COCKS, &c. "FALCON" INVERTED LAMPS, for street lighting. "ZENITH" INVERTED LAMPS, for outside shop, &c., lighting. "FALCON" INVERTED BURNER LANTERNS. SQUARE STREET LANTERNS. BURNERS and CONVERSION SETS for street lanterns, &c., &c.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants. We guarantee promptness with efficiency for Repairs. JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON. Telegrams: "SATURATORS BOLTON." Telephone 0848.

AMMONIACAL Liquor wanted. CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS. Telegrams: "CHEMICALS."

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere. FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, near LEEDS.

INVENTIONS.—Before protecting your idea send for free copy of our "GUIDE TO PATENTS." (1912 Edition). Full advice given on any subject—no trouble spared. Original testimonials for inspection. Highest references. Compare our inclusive fees.—WITHERS & SPOONER, Chartered Patent Agents, 323, High Holborn, LONDON, Estab. 28 years.

FOR Instructions on Polishing and Cleaning Gas-Cookers and Gas-Fittings, read Canning Handbook on Polishing, Electro-Plating, and Lacquering. Fully illustrated. Price 2s. 3d., post free; abroad, 2s. 6d. W. CANNING AND CO., BIRMINGHAM, and 18 to 20, St. John's Square, Clerkenwell, LONDON, E.C.

TAR WANTED.

THE Burnden Tar Company (Bolton), Ld., HULTON CHEMICAL WORKS, BOLTON. JOSEPH A. HUTCHISON, Managing Director.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

TO GAS AND WATER OFFICIALS.

BEFORE Purchasing your 1912 Cycle, kindly send post-card for our CATALOGUE, Cash or gradual Payments. Speciality, Slot-Meter Copper Collector. MELROSE CYCLE CO., COVENTRY.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services. It is also used for the Enrichment of Gas. Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE. Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron. Twice as rich as Bog Ore. Gives no back Pressure. The Cheapest in the Market. READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

PATENTS AND TRADE MARKS PUBLICATIONS: "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d. MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SULPHATE of Ammonia Plant made or repaired. Workmanship Guaranteed for Quality or Dispatch. Own Tools and Plant. Chambers, Towers, Saturators, Tanks, and General Chemical Works Plumber, Distance no object. Best References. Address, LEADBURNER, 15, Martin Street, STRATFORD, E.

WORKS Certificated Chemist of large London Gas Company desires Situation as ASSISTANT MANAGER in Medium-Size Works. Highest References. Address No. 5574, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MECHANICAL Engineer, thoroughly Practical, who has had long Experience in the Manufacture of Interchangeable Parts for Meters, Instruments, and Clockwork, by the latest Automatic Appliances, seeks RESPONSIBLE POSITION. Good Commercial Experience and Cost-Keeping. Address No. 5571, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Assistant Works Mana-GER in the Midlands, for a Structural Steel Works, with Foundry, Fittings, and Pattern Shops, employing about 600 Hands. Must be energetic, have good Organizing Abilities on Systematic Lines, well versed in up-to-date Practices, and able to Assist in Fixing Works Prices for estimating. Apply, by letter, stating Age, Salary required, and References (in Confidence), to No. 5569, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN required for Constructional Works in Midlands, Experienced in Gasholders, Tanks, Scrubbers, Condensers, &c. Apply, by letter, stating Age, Salary, and when could commence, to No. 5560, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FIRST-CLASS Draughtsman, Experi-enced in Vertical Settings, Wanted. Apply, by letter, stating Age, Experience, and Salary required, to No. 5572, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN, Experienced, Wanted—one with full knowledge of Gas-Works preferred. Applications, stating Age, and Salary required, with *copies* of Testimonials, to be addressed to the undersigned on or before Tuesday, May 28 inst. C. STAFFORD ELLERY. Gas-Works, Bath.

WANTED, a General Foreman in a Suburban Gas-Works with a make of over 200 Millions. Applicants must have Experience of Regenerator Settings, Electrical Stoking Machinery, Carburetted Water Gas, and the General Routine of a Gas-Works, and be a Good Controller of Workmen. Wages according to Experience. Free House, Coal, and Gas. Apply, by letter, to No. 5575, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CORRESPONDENT required by Im-portant Firm for Assisting High-Pressure Department. Previous Experience Preferred. Full Details to be addressed to No. 5568, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Meter Representative for Lancashire, Yorkshire, and Surrounding District. Must have established Connection with Gas Undertakings. Liberal Salary to First-Class Man. Apply, by letter, to No. 5573 care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good man to Sell Gas COAL in Midland District. Good Payment to First-Class Salesman. Apply, by letter, to No. 5576, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COUNTY BOROUGH OF DEVONPORT.
(GAS DEPARTMENT.)

WANTED, a thoroughly Trained and Experienced Engine Fitter, who will act as Working Mechanic in Charge of Machinery. Preference will be given to one who has a special knowledge of Hydraulics. Wages £2 per Week, with House on the Works, Coals, Gas, and Rates Free. Applications, in writing only, stating Training, Experience, present Employment, Age (not to exceed 40), and if Married, endorsed "Fitter," addressed to the ENGINEER, Gas-Works, DEVONPORT, to be sent in on or before the 25th inst.

W. P. TERVET, Engineer and Manager.

WANTED, a Second-Hand Combined WASHER and SCRUBBER, to Pass 600,000 Cubic Feet of Gas per day. Either Horizontal Rotary Type with Steam-Engine complete, or Vertical Tower Type with Tank and Tippler—each case to include Bye-Pass Connections, Valves, and Filling. Offers, with full Particulars, to be sent to the STANLEY AND DISTRICT GAS COMPANY, 9, SANDHILL, NEWCASTLE-ON-TYNE.

WANTED, Second-Hand Sulphate PLANT—10 to 20 cwt. of Salt Per Day. Apply to No. 5577, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-METER (second-hand) wanted, dealing with 100,000 Cubic Feet per hour—possibly on Hire. Write, giving full Particulars, to No. 5570, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TWELVE-INCH Four-Way Valves (by Cockeys), Offers Invited for Two, Second-hand, Twelve Years old, in good order, removed during Extensions. E. H. MILLARD, Engineer and Manager, Cowes Urban District Council, Gas Department.

FOR SALE—The Brighouse Corpora-tion have the following PLANT FOR SALE:—
Two 18 ft. by 16 ft. by 5 ft. PURIFIERS, complete with Lifting Apparatus and two 10-inch Four-Way Valves and Connections, with Girder Floor and Cast-Iron Columns.
One Braddock 40,000 Cubic Feet per hour square type STATION METER, complete with Valves and Connections.
Inspection by arrangement with HAROLD DAVIES, Engineer and Manager.
Gas-Works, Mill Lane, Brighouse, May 13, 1912.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

THE above Company have for Dis-posal Two Sets of Three PURIFIERS, 20 ft. by 10 ft., by 4 ft. deep inside, with Two Centre Valves, 14-inch Connections and Lifting Apparatus Complete. Also one "Standard" WASHER, with ENGINE and 14-inch Connections, and three TOWER SCRUBBERS, 28 ft. 6 in. high by 7 ft. internal diameter. All in Good Condition.

J. W. AUCHTERLONIE, Engineer and Manager.

May 6, 1912.

LOUTH GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Louth Gaslight Company invite TENDERS for the Supply of 4500 Tons (more or less) of GAS COAL, to be Delivered at the Company's Works during a period of One Year. Forms of Tender may be obtained on Application to the Secretary. Sealed Tenders, endorsed "Tenders for Coal," to be Delivered on or before the 1st of June inst., addressed to the Secretary, Gaslight Company, Louth, Lincolnshire. The Directors do not bind themselves to accept the lowest or any Tender. Personal Canvass disqualifies. No Agents need Tender.

PHILIP ALLISON, Secretary.

May 14, 1912.

BUXTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the Surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works during the Twelve Months commencing the 1st day of July next. For Conditions and Form of Tender, Apply to Mr. F. G. Shaw, Engineer and Manager, Gas-Works, Buxton. Sealed Tenders, endorsed "Tender for Tar and Ammoniacal Liquor," to be Delivered to the undersigned not later than Monday, June 3, 1912. The highest or any Tender not necessarily accepted.

By order, JOSIAH TAYLOR, Clerk to the Council.

Town Hall, Buxton, May 14, 1912.

BRECON GAS COMPANY.

TENDERS are invited for the Supply of 2500 Tons of GAS COALS, (Large, Cobbles, Nuts, Peas, or Slack) and 300 Tons of CANNEL Delivered at the Brecon Railway Station as required during the Twelve Months ending June 30, 1913. Tenders to be accompanied by Analyses and to state the name and size of Coal offered, and the name of the Colliery from which supplied. Payments will be made Monthly. The Company reserve the right to divide the quantity between two or more Contractors. Tenders to be received before noon on the 29th of May, endorsed "Tenders for Coal," and addressed to the Chairman of the Company, Lion Chambers, Brecon.

WM. A. WRIGHT, Secretary.

ROYAL BURGH OF INVERNESS.
(GAS DEPARTMENT.)

CONTRACTS FOR COAL, LIME, FREIGHT, INSURANCE, DISCHARGE AND TRIMMING.

THE Inverness Gas Commissioners are prepared to receive TENDERS for the Supply of 10,500 Tons, or thereby, of CANNEL, GAS, and SPLINT COALS, to be quoted f.o.r. at Pits and f.o.b. at Ports on the Firth of Forth. Delivery to be made over the ensuing Twelve Months, as required by the Commissioners. Also 300 Tons, or thereby, of SHELL LIME, to be Delivered free at Inverness Goods Station. Offers are also invited for the FREIGHT and INSURANCE of Coal from Firth of Forth Ports to the Upper Harbour, Inverness, in Steamers carrying about 300 Tons; also for the DISCHARGE of Seaborne Coals, and TRIMMING of same at the Gas-Works, when required. Further Particulars and Forms of Tender may be obtained by Applying to the Manager at the Gas-Works. Tenders, endorsed and addressed to Kenneth Macdonald, Esq., Clerk to the Commissioners, will be received up to Twelve o'clock, noon, on Monday, the 27th curt. The Commissioners do not bind themselves to accept the lowest or any Tenders.

Gas-Works, Manse Place, Inverness, May 16, 1912.